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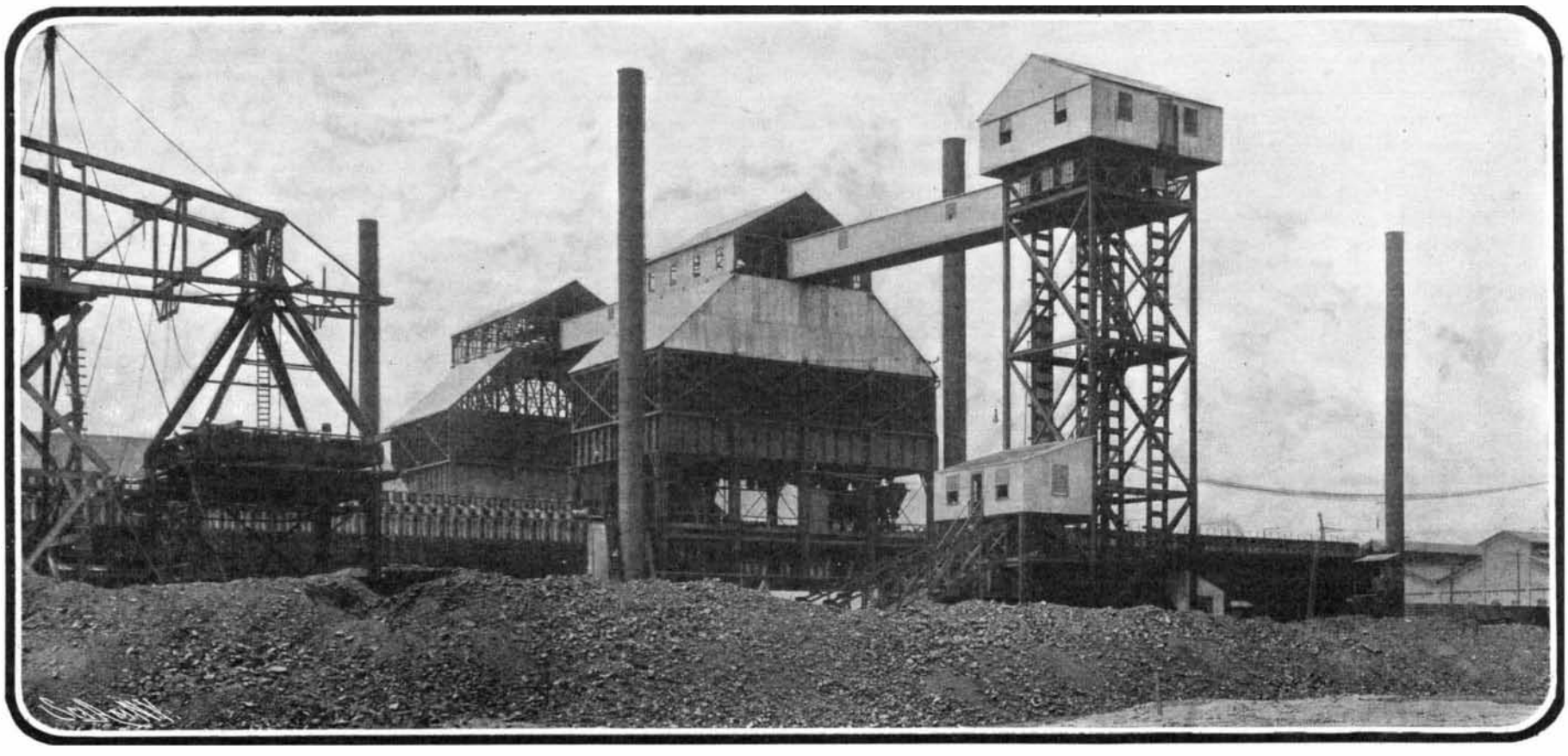
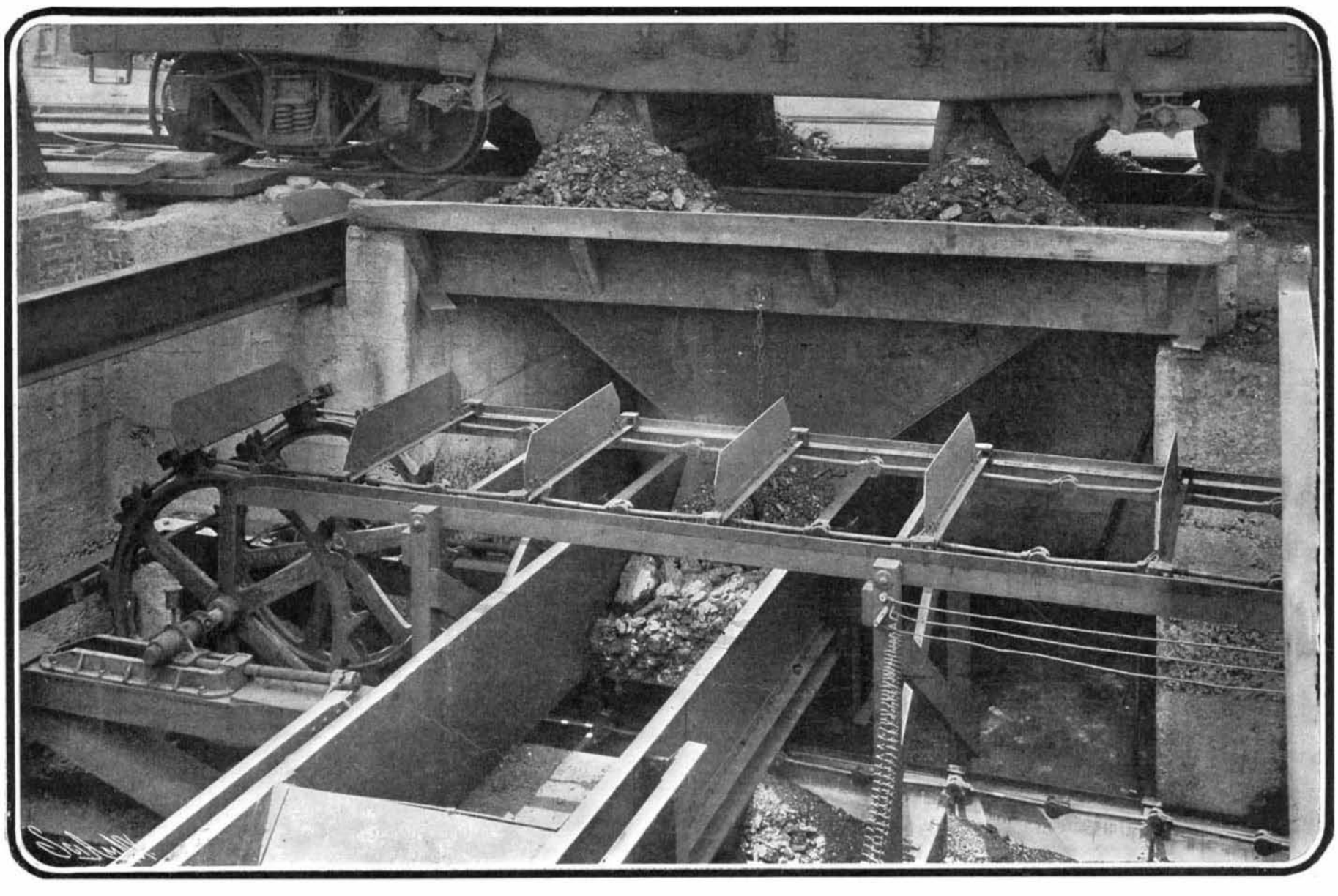
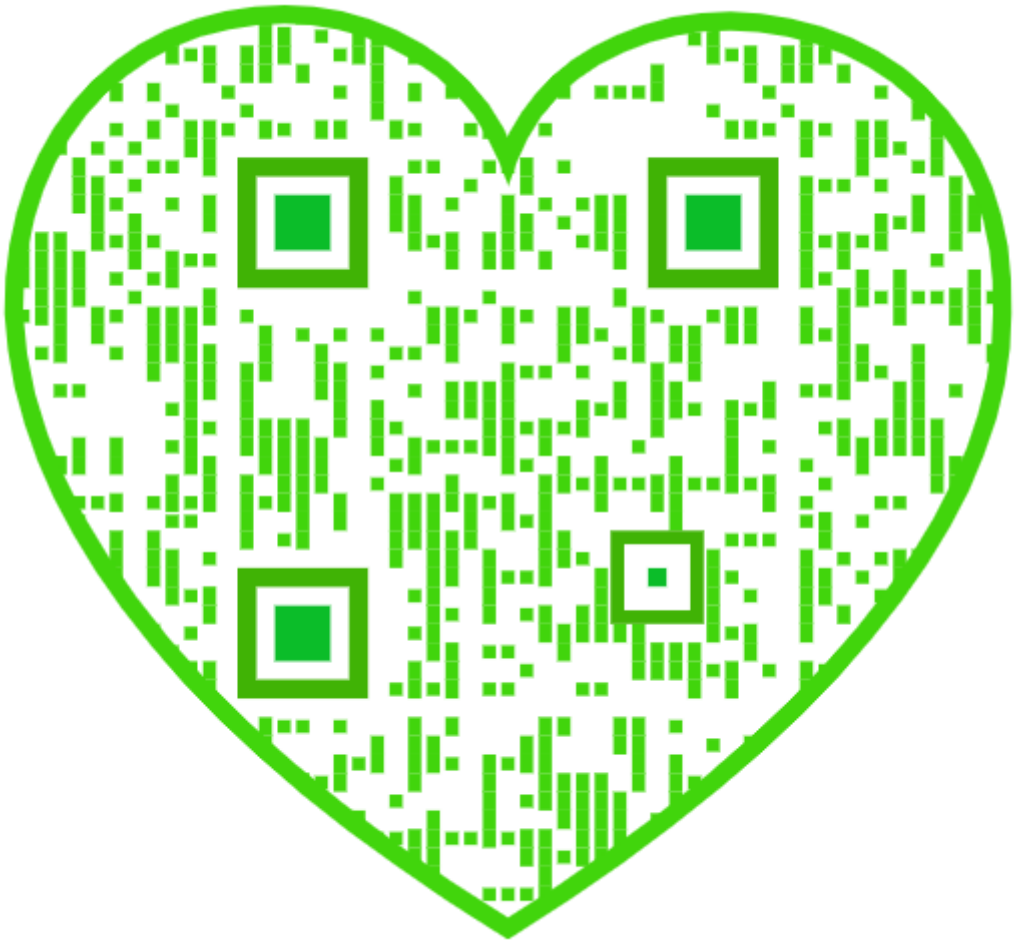


General View of a 200-Coke-Oven Plant of a Modern Steel Works.



One of Four Steel Track Hoppers Fitted with Reciprocating Feeder Which Transfers the Coal to Inclined Suspended Light Conveyer.

THE USE OF ELECTRICITY IN DRIVING COAL-CONVEYING MACHINERY.—[See page 413.]



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NEW YORK, SATURDAY, DECEMBER 10, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CLOSE OF THE ST. LOUIS FAIR.

The Exposition at St. Louis which was opened to the public with an attendance for the first day of about 180,000 was brought to a close on December 1, with a record of over 200,000 admissions. The closing day was marked by ceremonies expressive of the debt which the Exposition owes to the executive ability and enthusiasm of its president, the final addresses being delivered in the Plaza St. Louis, and at the foot of the Louisiana Purchase Monument, where seven months ago the Exposition was formally declared to be opened. The Exposition buildings were closed at four o'clock in the afternoon, and at midnight the splendid illuminations of Festival Hall and the Cascades slowly faded out for the last time, leaving this, the largest, most ambitious of the great international expositions, a matter of history.

Interest naturally centers at this time in the finances of this great undertaking, and according to a statement of the secretary the project, since its inception, has cost about $22,000,000 to the Exposition Company, while the several States and Territories have expended a total of $9,000,000. There were 18,500,000 admissions and the receipts reach a total of about $10,000,000, which is made up of admissions and concession royalties. It was announced that when a few current accounts have been paid, most of the $1,000,000 in hand will have been consumed, leaving only a small amount for the stockholders. From the amount of royalties collected, it is estimated that the various concessionaires must have taken in at least $10,000,000. The entire cost of the whole fair, including the various concessions, is estimated at about $50,000,000. With the bringing to a close of one more of these colossal expositions, the question will be asked again as to whether they pay. From the figures given above it is evident that financially they do not; but everyone who has visited this fair and taken note of the character and behavior of the multitudes that streamed through the various Exposition palaces, will surely give it as his impartial conclusion that as a great educative force, whose influence is much wider than can be measured in turnstile statistics, the last of the world's fairs must, in a broad sense, have been a profitable undertaking. One of the most instructive agencies in that dissemination of knowledge and information which an exposition is designed to afford is the local correspondence of the various papers; and as evidence of what may be accomplished in this way, we refer to the pages of the SCIENTIFIC AMERICAN and the SUPPLEMENT during the past seven months, in which can be found what is practically a complete *résume* of the most valuable features in the architecture and exhibits of the Exposition. It is impossible to estimate how many millions have looked at the Exposition through the eyes of the press; but it may safely be said that the 18,500,000 registered at the gates represent but a fraction of the people who, not merely in America, but throughout the world, have by this means been made familiar with the buildings and exhibits of the Louisiana Purchase Exposition.

BALDWIN AND SANTOS-DUMONT.

It is refreshing to meet with an enthusiast who takes such a common-sense and dispassionate view of his art as does the aeronaut, Mr. Baldwin, whose work at the St. Louis Exposition gives him the same standing among experimentalists in the dirigible balloon in this country as is held by Santos-Dumont in France. During a recent visit to this office, Mr. Baldwin paid a high tribute to the Brazilian aeronaut, stating that, in his opinion, no one man had done so much to place the airship on a practicable basis as the young Brazilian; and he took occasion to scout the idea that the failure of Santos-Dumont to appear at the World's Fair contest was due to any other cause than the malicious act of some jealous or crazy fanatic. It was his opinion that, had the balloon not been willfully damaged, Santos-Dumont would undoubtedly have been one of the contestants and would have added very largely to the interest of the aeronautical programme. This testimony from the man who, as events proved, would have been his most active competitor, will be taken at its full significance.

It was Mr. Baldwin's opinion that the many failures of inventors of airships of the dirigible-balloon type are largely due to their lack of aeronautical experience "in the air." He himself is an old gymnast, and he attributes much of his own success to the art of balancing acquired in years of work on the tight rope. In the successful aeronaut there must be a certain amount of what might be called the instinct of equilibrium. This will enable him to almost anticipate the sudden lurches and deviations, and apply that instant correction which is necessary for successful navigation. Although all his work has been done with the gas-balloon type, Baldwin believes that the ultimate successful airship will be of the aeroplane type, and will be framed, driven, and balanced on the same principles that govern the flight of birds. He frankly admits that the dirigible balloon will never have a commercial value; but he believes that, in its perfected condition, it will come to be recognized as one of the most attractive forms of sport, taking its place with the yacht and the automobile. Incidentally, it should be mentioned that Baldwin compares the pleasure of sailing in his airship with that experienced in holding the wheel of a sailing yacht, the response to the slightest changes of the rudder being immediate and proportionate. Although he was the most successful competitor at St. Louis, he is so firmly convinced that the future of human flight lies in the direction of the aeroplane, that he has already directed his attention to this type, the practical possibilities of which were shown by the successful flight of the Wright brothers not many months ago.

DEATH OF A FAMOUS YACHT DESIGNER.

One of the best tributes to the late G. L. Watson, the foremost yacht designer in Great Britain, is the widespread interest and regret which his death has aroused on this side of the Atlantic. His claim upon American interest is two-fold. In the first place, of the various naval architects who have designed racing yachts to compete for the "America" cup, he was unquestionably the most successful; for, although none of his yachts succeeded in winning the cup, there were two of them, "Valkyrie II." and "Shamrock II." that showed such excellent qualities as to render the successful defense of the cup uncertain until the last race of each series was won. To a more limited class of Americans Mr. Watson was well known and highly esteemed for his handsome and successful steam yachts, many of which fly the flags of our leading yacht clubs. At a time when yacht designing was still largely a matter of rule-of-thumb, Mr. Watson, who was a trained engineer, began to apply to yacht designing those scientific principles upon which yacht designing is now almost entirely conducted. That he was right was proved by his early successes. His most noted yacht was the cutter "Britannia," which did such good work in English waters against our own "Navaho" and "Vigilant." With Mr. Watson gone, the prospects of another competition for the "America" cup, at least in the near future, are very remote. Mr. Fife, the designer of the last cup challenger, has absolutely refused to build a fourth "Shamrock;" and there are no indications that among the younger naval architects in Great Britain there is any coming man who can successfully compete with our own designers in the construction of an extreme, high-powered racing craft.

STEEL TRACKWAY ON STREETS.

The steel trackway which was laid a few years ago on Murray Street, in New York city, has been removed to make way for a pavement of wooden blocks; but it will be unfortunate if this fact is allowed to raise any doubts as to the value of steel trackway, provided it is used under conditions suitable to its operation. In the present case, the track consisted of a pair of 12-inch channels, laid with their flanges below the surface and with upper face flush with the roadway. The channels were supported on broken stone which rested on a macadamized bottom that was surfaced with gravel. The location of this track and the peculiar circumstances surrounding it were altogether unfavorable to a test of its good qualities. In the first place, it was only about 400 feet in length, and it was laid on a street, one side of which was almost constantly encumbered by trucks that were engaged in loading or unloading from the adjoining buildings. This forced the traffic to the opposite side of the street, and rendered it often more convenient for a truckman to use the cobblestone surface than the smoother-running steel trackway. There is not the slightest question that the reduction in traction resistance when a loaded truck was being pulled up the Murray Street hill on the trackway was very much less than if the same load were hauled on the rough granite pavement. With the repaving of the street with wood, the difference in traction resistance was, of course, greatly reduced, and no doubt the authorities acted wisely in not relaying the steel track.

We have always considered that the province for the steel track for highways was to be found in country districts, where the local material for road-building was poor and the difficulty of maintaining a surface suitable to heavy traffic was great. The system should prove particularly valuable on long hills and, indeed, a suggestion of its utility is found in the fact that on the old coaching roads in Europe, stone paved trackways were sometimes laid on steep hills on which the traffic was heavy, with a view to reducing tractive resistance.

METEOROLOGICAL OBSERVATORIES AT SEA.

At the St. Petersburg meeting of the International Commission on Scientific Aeronautics, reports were received of progress in a new field which, in the opinion of the commission, will in future attract much attention.

At the first meeting of the commission in Strasburg, in 1898, Prof. Rotch, director of the Blue Hill Observatory, near Boston, pointed out the pressing need of observations of the higher strata of the atmosphere over the ocean which covers two-thirds of the globe. Councilor Assmann, director of the Prussian aeronautical observatory in Berlin, took up the idea, and his assistant, Prof. Berson, elaborated, with Rotch, the plan of an expedition to make observations on the Atlantic, but the plan was not carried out owing to lack of funds and the impossibility of securing a vessel.

Prof. Hergesell, chief of the Alsace-Lorraine weather service, was the first to use kites to carry self-registering instruments aloft over the water. His first experiments, on the Lake of Constance in 1900, were followed by some very successful ones made by Berson and Elias on a trip to the North Cape.

Last year Teisserenc de Bort, well known through his extensive observations by means of kites and captive balloons at Trappes, near Paris, erected an observatory at Viborg on the northern point of Jutland, a site virtually oceanic, though selected chiefly because it lies in a main track of atmospheric low pressures.

But it was reserved for Prof. Hergesell to institute a series of systematic observations at sea. Last spring he succeeded in interesting Prince Albert of Monaco in the subject. In April, in the Mediterranean, eleven kite ascensions were made with the aid of the deep-sea sounding apparatus on board the Prince's yacht, and the following positive data were obtained:

In anticyclones (high pressures) the vertical distribution of temperature differed from the normal distribution over land areas, but the data are not sufficient to establish the law of variation. The velocity of the wind decreased very rapidly with increasing elevation and an almost perfect calm was found at a height of a few hundred meters. In cyclones (low pressures) the conditions were found to be the same as on land.

Off the Corsican coast regularly alternating land and sea breezes facilitated the ascensions, but here, also, a sudden lull was observed at a height of 200 meters. Off the northern point of Corsica atmospheric eddies caused the pull of the kite to fluctuate between 0 and 80 kilogrammes and the kites were often carried away by gusts.

The success of this experimental series induced the Prince of Monaco to equip his yacht with a complete kite-flying outfit and to undertake an Atlantic cruise in July. In the interim the yacht, with the Prince and Prof. Hergesell aboard, visited the Kiel regatta, where the German Emperor became so greatly interested in the experiments that he had the "Hohenzollern" and the "Sleipner" equipped with kite-flying apparatus for their northern cruise.

The Atlantic cruise of the "Alice," the Prince of Monaco's yacht, extended from the latitude of Oporto southwardly to the Canaries, and occupied four weeks. The kite frequently rose higher than 2,500 meters and once as high as 4,510 meters. After Hergesell's departure the Prince continued the experiments and attained a height of 6,000 meters. In the latitude of Gibraltar the trade-wind was observed as a uniform eddyless northeast wind of 6 or 7 meters per second, accompanied by the characteristic trade-wind clouds, elongated cumuli. Above 500 meters there was a sudden lull to two or three meters per second. The kite was allowed to lie upon the uniform lower wind as on a cushion while a great length of line was paid out. Then by hauling in rapidly the kite could be sent very high. The anti-trade which, according to earlier observations at Teneriffe, blows strongly from the southeast at great elevations, was not found up to the height of 4,510 meters, but a slight easterly breeze replaced the strong northeast wind observed below. In the moist lower strata the temperature was found to decrease by 0.5 deg. C. for each 100 meters of ascent. At a height of 500 meters a layer of almost uniform temperature, 1,100 meters thick, was met. Above this, again, there was a decrease of 1 deg. C. for each 100 meters rise. The relative humidity was found nearly constant at 75 to 80 per cent in the zone of the trades.

whence it fell abruptly to a nearly constant value of about 30 per cent.

These interesting results, of course, must be confirmed and extended by further observations. As many ocean stations as possible should be established and connected with land stations by wireless telegraphy. In view of the cost, such stations are not likely soon to be too numerous.

Regular observations on the Lake of Constance are, however, assured. Prof. Hergesell continues his experiments there on the days fixed upon for simultaneous international observations (usually the first Thursday of each month), and at his instigation the local and imperial governments have agreed to take up and extend the work.

But observations at sea are more important, and it is gratifying to note that the Hamburg-American and North German Lloyd companies have consented to permit kite observations to be taken, in future, aboard their vessels. A Spanish transatlantic line is said to have given similar permission. It is impossible to predict the result of the extension of such observations over the ocean, but it seems certain that the basis of weather "probabilities" would be vastly improved thereby.

WILL "LIGHTWOOD" DISPLACE THE LONG-LEAF PINE IN TURPENTINE DISTILLATION?

BY THOMAS ARTHUR SMOOT.

The days of the prestige of the long-leaf pine are gone. Time was when it was king in the South. Our geographies used to tell of the supremacy of North Carolina in the production of naval stores, whence came the name, "Tar Heel State." The schoolboy was proud of the distinction, and little dreamed that only the appellation of his State would remain, while the pre-eminence for the products would soon be claimed by more southerly States in rapid succession. But such was the case. Not many years passed before South Carolina was first, then followed Georgia, while Florida is now chief in the production of "tar, pitch, and turpentine," though the yearly output in Alabama, Louisiana, and Mississippi is large. Along with this receding line of the virgin long-leaf, rapidly drawing in about the Gulf of Mexico, the turpentine worker, with his squad of negro employes, is intimately linked. First he had his headquarters in Wilmington, then Charleston, later Savannah, while now his billheads bear the mark of Jacksonville. He has made money, this migratory man of the pine forests, but now he shakes his head sadly, saying, "It'll all soon be gone," referring to the rosin upon which he is so dependent. The passing of this great industry, with its little army of hardy toilers, reminds us of the sad vanishing of the Indian tribes before the whites. The turpentine workers left behind them the blazed forests, whitening unto their death. Many died from being so unmercifully drained of their sap, others fell by the woodman's ax, all, in one way or another, melted away. Great areas of timbered lands have been bought up by the corporations, until now no considerable amount of pine forest remains in individual hands. These forests of timber have been, or are now being, literally mowed down by the woodman, and not many years after the turpentine man has been stopped by the Gulf, the lumberman will be compelled to lay down his ax and saw on the same shores.

What will the next generation do for lumber with which to build their houses? It does look as though some steps ought to be taken to protect our descendants against a timber famine. Selfishly speaking, they will have to do as we have done—shift for themselves, and adjust themselves to such conditions as confront them. We, who are using the lumber from sapped trees now, are building houses that our fathers would have considered scarcely worth putting up. They used nothing but the best heart lumber, from the pure virgin pine. All is changed to-day, and the builder of a house is glad to get any sort of material, the white-streaked and knotty sorts being the order of the day. But when even the drained and exhausted long-leaf of to-day is gone, what? Why, the people will have to use the short-leaf, which will always abound in the Southern States. All that it requires, to be abundant, is to let it alone. Throw out an old field as worthless for farming purposes, and in twenty-five years you will have a short-leaf pine forest, which will make some kind of lumber. It will be white and soft and knotty, but our descendants will by that time have discovered paints and other preservatives that will protect it, so that the world will go merrily on, in blissful ignorance of the stately, handsome, and more desirable long-leaf that once was.

The resinous products of the long-leaf pine, however, are what the outside world has been most interested in, and has most needed and used. Tar, pitch, and turpentine are necessary to the commercial world. Whence can these necessities be supplied, when the trees that now furnish them are gone? The answer is, from the very stumps of the pine trees that once flourished, and from the lightwood knots and fat pine trunks that lie strewn all over the pine forests, or the areas where once the forests grew. This lightwood will keep for an indefinite length of time, and as long as it lasts, the needs of the world for the commodities under discussion will be supplied. Throughout the Southern States, there is just springing up a new and most interesting industry—that of the extraction of the resinous substances from this lightwood. Being in its incipiency, the industry has not yet gotten the full confidence of the public, nor has it been developed to that state of perfection to which it will be brought with a few years of experience.

The old process of making turpentine is well known, consisting in placing the crude rosin in a copper retort and evaporating it by slow fires. The vapors thus produced, when collected in the condenser, form the pure commercial spirits turpentine, while tar and other valuable by-products are found in the residue. The new process of extracting these products from the lightwood itself consists in putting the wood, say two cords at a time, into a great iron retort, into which open several steam pipes. The steam is then injected into the retort, where, kept under a temperature of from 200 to 212 degrees, the fat pine gradually yields its resinous contents. These are all collected in a condenser, just as the vapors in the ordinary still. But the result is a heterogeneous mass, containing turpentine, tar, and the numerous by-products. In order to get the separate products, this whole mass is now placed in a copper retort, similar to that used in distilling the pure rosin, and is evaporated in like manner to it. The final products are wood spirits, turpentine, tar, and by-products almost too numerous to mention. These by-products deserve special notice. Several of them, the most abundant in quantity, are utilized in mixing certain paints, in which there is no danger of marring the colors. A number of others are being used for medicinal purposes. The great difficulty in their use lies, not in the production of them, for it is well known that this hydrocarbon series may be carried on to an almost unlimited extent; but it is in their unstable nature that the trouble rests. What they are to-day, they may not be to-morrow. Notwithstanding this instability, they are being tightly bottled to prevent as far as possible their breaking up, and are being sold in considerable quantities by some factories. Furthermore, the most skilled chemists are constantly working toward methods of increasing their stability.

It is quite natural that the introduction of the new by-products should be met with opposition. The turpentine was first attacked because of its yellow color. The lightwood factory's chemist immediately went to work and discovered a means of making it clear. Next, it was claimed that the turpentine was little more than wood alcohol, but that idea was successfully routed. The present ground of attack is upon the asserted inferior specific gravity of the wood spirits turpentine, and this claim is now being vigorously assailed by the opposition.

RADIO-ACTIVE MINERALS.

Among the principal radio-active minerals may be mentioned thorite and orangite. Both of them have been examined by M. Curie. These two minerals are analogous as regards their chemical composition, but they are distinguished from each other by their exterior aspect and the different amounts of thorium which they contain. As to thorite, it is a hydrated silicate of thorium which contains about 60 per cent of oxide accompanied by a great number of bodies, among which are oxides of iron, manganese, calcium, uranium, magnesium, and lead, with potassium and sodium compounds and stannic acid. This mineral is obtained principally in the neighborhood of Brevig, Norway. In the natural state the thorite is found in the form of amorphous masses whose color varies from chestnut brown to blackish brown. It is found but rarely in the crystallized state; in this case it occurs in dodecahedral crystals. In general the thorite which occurs in Norway has a resinous luster and a conchoidal fracture. When reduced to thin plates it is translucent and sometimes even transparent. Its density varies from 4.6 to 4.8 and its hardness is 4.5. The main characteristics which enable it to be distinguished are in the first place its color, then its density and hardness. Some additional tests are also needed. When heated, it gives off water vapor. On treating with hydrochloric acid it is attacked, and forms a jelly-like mass. Sulphuric acid dissolves it when hot, even after calcination. It is only fused with difficulty by the blowpipe. When melted in a borax drop at the end of a platinum wire it gives an orange-yellow mass which becomes grayish upon cooling. A little nitrate of potash added to the melted drop allows the orange tint to remain even after cooling. It is in one of the specimens found at Brevig that Berzelius discovered thorium in 1828. Mme. Curie examined a great number of specimens of thorite. The following figures show the radio-activities of these different specimens, taking metallic uranium as unity. Uranium, 1.0; thorite from Lovo, Sweden, 0.58; different thorites, 0.04, 0.13, 0.57, 0.62. These determinations were made with an electrometer method which is very precise. It consists in measuring the current which passes in a condenser formed of two plates, on the lower of which is placed the test substance.

The second mineral, orangite, is a variety of thorite. It always accompanies the latter, and it is also found at Brevig, Norway. However, its color is different. It is either orange-yellow or orange-brown. Its proportion of oxide of thorium varies from 70 to 75 per cent. Its density is 5.4. The distinctive characteristics of this mineral are the same as for thorite. As the mineral is richer in thorium it is also more active, and some samples which were found showed a relatively high activity. The result of a certain number of measurements, taking uranium as unity, gives the values 0.87, 0.68, 0.99, and 1.10.

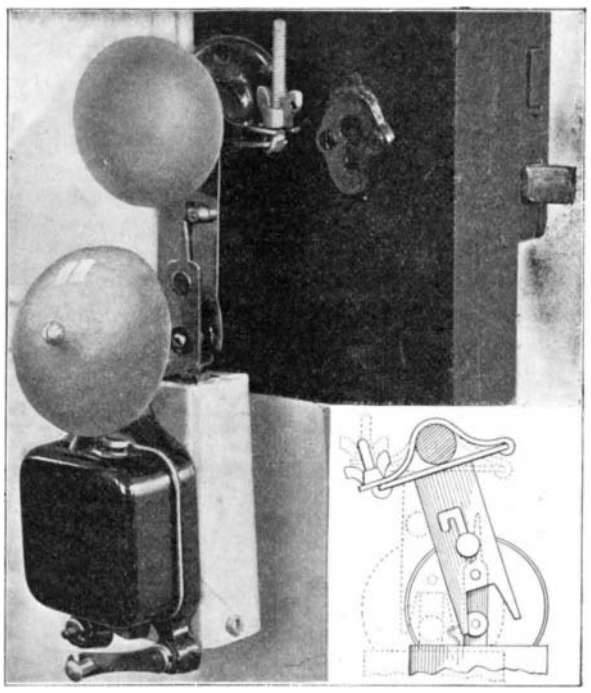
SCIENCE NOTES.

The annual report of the Paris Observatory for 1903 deals with a number of researches of special interest. The seventh section of the Atlas of the Moon has appeared, containing seven plates which seem the most successful yet issued, and in some respects to show a considerable advance over the best views of the moon obtained by the eye at the telescope. With respect to the Astrographic Chart, eleven plates have been passed as satisfactory, and thirty-five charts containing the triple images of 47,300 stars have been distributed. It is hoped that the second volume of the Photographic Catalogue will appear by the end of the current year. The determination of the solar parallax from the photographic observations of Eros is advancing toward completion. Of standard stars 1,661 meridian observations have been made, and 10,858 photographic observations of comparison stars, of standard stars, and of stars near the path of Eros. Three important researches based upon new methods are included in the programme for the future work of the observatory: the first relates to the determination of latitude and of its variations; the second is for the precise determination of the constant of aberration, two portions of the sky, distant 90 deg., being presented in the field of the instrument at the same moment by means of a double mirror; and the third relates to the employment of M. Lippmann's photographic object-glass in meridian observations.

Messrs. Charabot and Herbert give an account of their researches upon the successive states of vegetable matter in a paper recently presented to the Académie des Sciences. In studying the distribution of the odoriferous components in the mandarine and the bitter orange, Charabot and Lalone previously observed that the essence contained in the stem is less soluble than that which the leaf contains, especially in the case of the older growths. These conditions of relative solubility in which the odoriferous matter is found in the different parts of the plant may hold good only for such products, or these conditions, on the other hand, might be a general rule for the distribution of vegetable matter. This is the question which the experimenters set themselves to solve in the present case. Their researches, made by special operative methods, bore upon the basilic (*Ocymum basilicum*) the mandarine (*Citrus madurensis*) and the bitter orange (*Citrus bigardia*). They showed that if the organs are sufficiently developed, it is the leaf which has the greater proportion of soluble matter, both organic and mineral. On the contrary the proportion of these matters is a minimum in the root. In general, during the development of an organ the proportion of soluble substance is lowered, but it does not seem to vary to a great extent in the leaf, where it continues to predominate in a constantly increasing degree. The authors reach the conclusion that the difference in solubility between the leaf and stem matter is of the same order and varies in the same way as the difference in solubility between the essences extracted from each, according to Charabot and Lalone. The root and stem are formed of less soluble matter. In the leaf the solubility of the organic substances considered, as well as of the total matter, does not undergo any great variation, after a certain epoch of growth. In the case of the leaf, it is no doubt the phenomenon of assimilation which keeps the equilibrium as regards the organic matter. When a given substance changes in character and becomes insoluble or else leaves the leaf to enter another organ of the plant, this same substance re-appears on account of a continuous chlorophyllian work. In the stem it seems that the diminution of the solubility of the organic matter is due to the formation of less soluble compounds or a migration of soluble compounds toward organs which are in process of formation, especially in the case of inflorescence, where a specially important work goes on. To the observation that the soluble matter is less in the stem than in the leaf must be added the fact that the proportion of water in the former undergoes a greater diminution than in the latter, between the two periods of growth we are considering. The osmotic pressure would tend to increase in the stem and thus cause an exodus of soluble matter toward the inflorescence, which has a large proportion of water.

A SIMPLE BURGLAR ALARM.

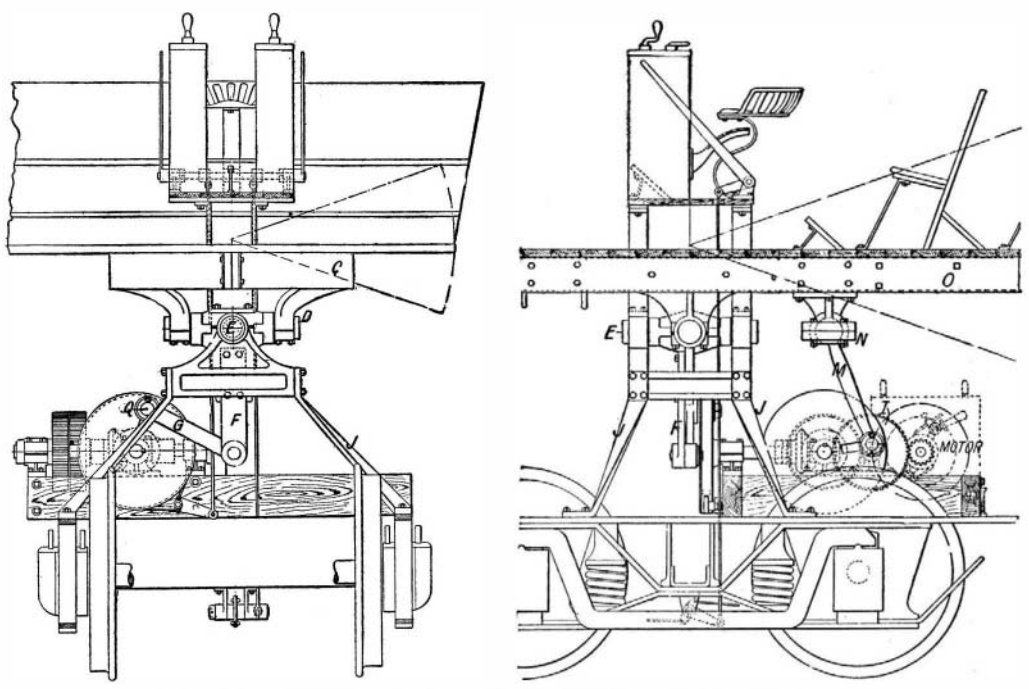
Dwellers in flats or apartments have a particular dread of sneak thieves, and have long felt the need of some simple alarm which would give notice of the unauthorized opening of the door, or even the trying of the door knob. A patent has just been granted to Mr. Amos Getto, of 873 Second Avenue, New York city, on an alarm which should meet these requirements. The alarm is illustrated in the accompanying engraving. It consists of an electric bell and battery formed with a hanger strap which is pivoted to a plate clamped by means of a thumb screw to the door knob. The battery, which is preferably a small dry-cell, is carried in an aluminium case at the back of the bell, and may be easily removed when desired, by drawing out the rod which extends across the open bottom of the case. One pole of the battery is electrically connected to one terminal of the bell, through the switch shown at the bottom of the bell. The other pole of the battery connects with a contact piece mounted on, but insulated from the hanger strap. The plate on which this strap is pivoted is provided with two prongs, as shown in the detail view. When the door knob is turned, it swings the plate from the position shown in dotted lines to that shown in full lines, when it will be observed, that one of the prongs makes connection with the contact piece on the strap. The current is thus completed through the plate and pivot pin to the strap, which is connected to the other terminal of the bell. It will thus be seen that when the switch is closed, whenever the door knob is turned to the right or left, it will complete the circuit by means of one or other of the prongs on the plate, and thus ring the bell. As a burglar alarm, in order to continue the ringing of the bell, a pawl is provided which is adapted to slide in a slot in a plate. Normally the pawl rests in a notch at one side, as shown in the general view, but when in operative position, it rests on the pointed end of the hanger strap, so that when the alarm is swung by the turning of the knob, the pawl will slide down the slot, as shown in the detail view, wedging the end of the hanger strap to one side and holding the pronged plate and contact piece in electrical contact. It will be seen that the alarm is very simple and compact and may be very quickly attached to any door knob. Not only may it be employed on a dwelling house, but also in connection with safes, warehouses, and the like.



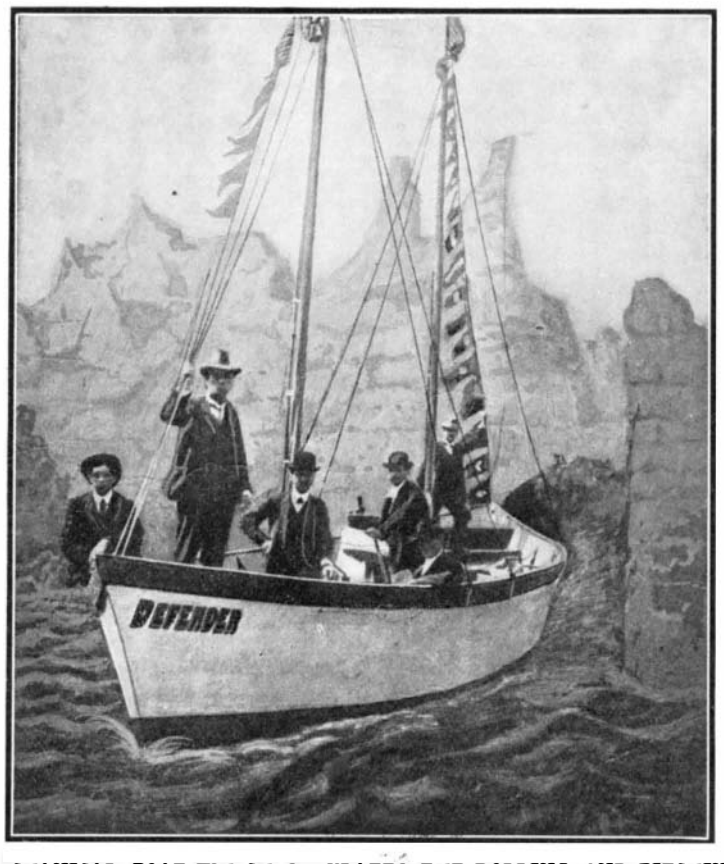
A SIMPLE BURGLAR ALARM.

A SEA VOYAGE ON LAND.

In the accompanying illustrations we show a novel amusement apparatus which, though adapted to travel on a track on land, is arranged to give the passengers all the sensations of a voyage at sea. The apparatus has the form of a boat, and in order to carry out the illusion, some flexible material such as canvas, painted to represent waves of water, is secured to the boat along the supposed water line, and stretches out for a certain distance each side of the boat. The canvas also serves the purpose of covering the mechanism which gives the boat the required rocking and pitching motion. This mechanism is clearly indicated in our detailed views of the apparatus. It will be observed that the deck of the boat is supported on a bracket *C*, mounted to turn in one plane on the shaft *D*, and in the other at right angles thereto, on the shaft *E*, which is journaled in the main frame. This universal joint connection allows for the rolling and pitching motion of the boat. A crank disk at the front of the boat is slowly rotated by an electric motor through suitable step-down gearing. The extension arm *F* on one of the universal joint members is oscillated by means of connecting rod *G*, and crank pin *Q*, on the crank disk. In this manner the boat is caused to rock slowly laterally, the extent of the list being determined by the position of the pin *Q*, which may be adjusted along a radial slot in the crank disk. The fore-and-aft motion of the boat is governed in similar manner by crank disk *I* and connecting rod *M*, which has ball-and-socket connection with the deck of the boat at *N*. The operator or pilot of the boat is seated on the platform which is supported directly by the main frame and he is, therefore, not subjected to the rocking and pitching movement of the boat. On this relatively stationary platform are the two controller boxes. One of these controls the motor which operates the rocking and pitching mechanism and the other controls the motor on the forward truck which propels the apparatus along the track. A couple of brake levers are also provided, one for quickly stopping the rocking motion, when desired, and the other for braking the motion of the truck. By using separate motors for propelling and for rocking the boat better control is had. The apparatus illustrated has been in operation for some time and has given very satisfactory results. The combined rocking and pitching of the vessel is very realistic and closely simulates the motion of a vessel at sea. The patent on this invention has been secured by Mr. George W. Scofield, of 302 Broadway, New York, N. Y.



Front and Side Views of the Mechanism for Rocking the Boat.



MECHANICAL BOAT WHICH SIMULATES THE ROLLING AND PITCHING OF A VESSEL AT SEA.

The Toy Industry of Germany.

Some interesting particulars of the toy industry of Germany have been published by the British Consul at Hamburg. Toys constitute one of the most important branches of German manufacture. In the year 1903 the total volume of toys exported from all parts of the German Empire was 34,717 tons, valued at $13,931,370. Though there is hardly any country in the world to which German toys are not exported the most important customer of Germany is Great Britain, which in the year under review received 12,218 tons. The second most important market for German toys is this country, the exports to which amounted in 1903 to 11,055 tons, valued at $4,093,135.

The most important centers for the manufacture of toys in Germany are Nuremberg and Fürth in Bavaria, Sonneberg and some other parts of Thuringia, and the Saxon "Erzgebirge." Nuremberg, above all, has long been known throughout the world for its toy trade and industry; and German toys, wherever made, still go in many countries by the name of Nuremberg toys. At Fürth, which is close to Nuremberg, a flourishing trade and industry has likewise sprung up since about the end of the eighteenth century. Next to Nuremberg and Fürth, the town and district of Sonneberg has for many years enjoyed the best reputation for its toy industry and trade; while in the Saxon "Erzgebirge," a district comparatively poor in natural products, the manufacture of toys has likewise for some time furnished a source of livelihood to thousands of the inhabitants. The toys made at Nuremberg and Fürth are chiefly of the metal variety, made either of tin, tinned sheet iron, or of tin and lead alloys. Of the more than 200 toy factories established in both of these towns, about 150 are devoted exclusively to metal toys; the only part of them worked by hand being the final painting, while all the rest is manufactured by machinery. In this respect this toy industry of the two Bavarian towns occupies a rather different position from that of all the other parts of Germany, where it is almost exclusively carried on by manual labor; that is to say, by workmen and women in their own homes. The success of the Nuremberg and Fürth metal toy manufactories is mainly attributable to the skillful manner in which the materials have been employed, and in which the machinery and tools used for the work have been adapted and gradually improved by the toy manufacturers themselves; thus enabling them to produce large quantities of articles within a comparatively short time, and to reduce the expenses of production, and in consequence also the sale prices of the articles manufactured by them.

Cloth Made Fireproof.

United States Consul Frank W. Mahin sends from Nottingham, England, the following information relative to a new cloth fireproofing material:

"In a paper read at a meeting of a society of dyers in Manchester, titanic acid (the oxide of titanium) was claimed to possess remarkable fireproofing properties, and evidence was produced in the shape of experiments by the reader of the paper. He took, for instance, some pieces of flannelette which had been treated with titanic acid, and put a match to them.

"The incipient fire in the material smoldered and went out, refusing to burst into a flame. The experimenter claimed that all inflammable textiles could thus be rendered fireproof, and that dyeing, boiling, or washing would not remove the acid, it becoming, in fact, an integral part of the fabric."

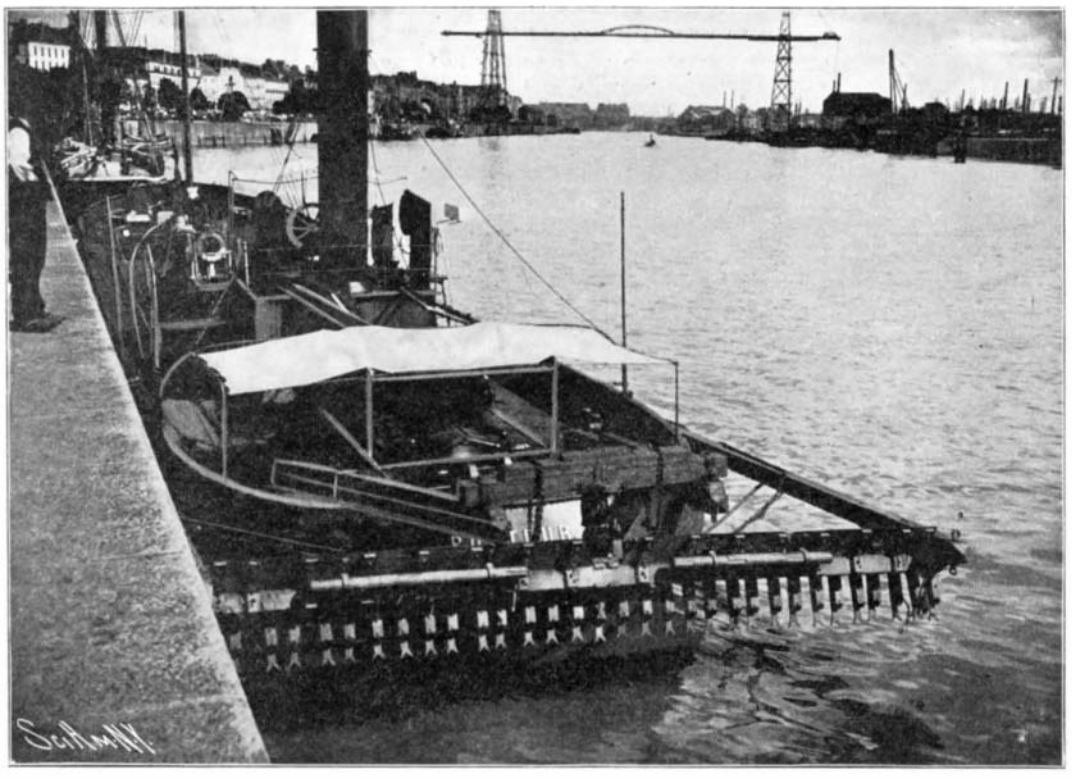
A new electric resistance furnace, designed by a German, Herr O. Frölich, is built up of bricks of a material which conducts the electric current in the cold state about twenty-five times less than carbon, and hot, sixteen times less; it is not attacked by direct currents of usual voltages, and the melting point lies above 2,000 deg. C. The furnace temperature of such a jacketed furnace can be pushed above 1,600 deg. C.

RIVER RAKE FOR CHANNEL DEEPENING.

BY J. PELTIER.

The river Loire is a somewhat capricious stream and by no means favorable for navigation. Its banks are formed of easily displaced and shifting sands, that during winter freshets threaten to fill the channel by the formation of shoals and bars. Engineering skill, however, has succeeded, by the building of suitable works and by continuous and intelligently-applied dredging, and also by the construction of a 10-mile canal around the most difficult portion of the river, in keeping the channel open. Ships drawing about 18 feet of water can reach Nantes at any time of the year, or any condition of the tides. Vessels drawing 20 feet can reach the city during spring tides, and occasionally, during the highest tides, vessels drawing as high as 23 feet of water have been able to deliver cargoes at Nantes.

During the present winter, after a season which witnessed the highest floods of the Loire of the present century, the river has fallen to an elevation as low as that in the year 1822, and the tides, flowing with rapidity up a comparatively shallow channel, carry a large amount of mud in suspension which, at slack water, settles to the bottom in the upper reaches of the Loire, where the water is rendered slack by the shallower portions of the river, which as yet have not been dredged. In order to prevent this accumulation, the Public Works have transformed a steam mud barge into what might be called a steam-rake barge. The barge is 131 feet in length, 23 feet in breadth and has a tonnage of 292 tons. The rake, which is adjusted across the stern, is 36 feet in length and weighs 2 tons. During ebb tide the barge, which has engines of 300 horse-power, takes up a position in the middle of the river and then lets go the rake until it rests on the bottom. The barge then steams from Nantes to the canal and back to Nantes, and continues to rake the muddy bottom until the next time of high water. Steam is delivered to the tines and the upper part of the rake and the agitation serves to loosen up the mud, which is carried in suspension by the ebb tide to sea. The method has proved highly successful.



STEAM BARGE WITH HEAVY RAKE AT THE STERN FOR DEEPENING THE CHANNEL OF THE LOIRE.

SKELETON MODELS OF WARSHIPS.

The costly, complicated, naval constructions of the present age are such intricate structures that the ordinary drawings are exceedingly difficult for the practical seaman to comprehend, and models that will show all details of the interior economy are necessary for the personnel on board to handle and fight a modern battleship most efficiently.

The drawings and blue prints that are furnished in the outfit of all vessels are technical productions, which cannot be readily understood by the men and which require even for officers considerable time to study. These plans are usually kept by the captain, executive, and officer in charge of the department of steam engineering. One is almost invariably obliged to go below into the compartment in question to get a correct idea of the situation, the relative space occupied by pipes, valves, etc., in a compartment and its relation to neighboring compartments. Detail drawings generally fail to show the environment of valves, etc., and inspection of the drawings is rarely satisfactory. Even after going below into store rooms the watertight bulkheads prevent direct access there to neighboring compartments, and an exact idea of surroundings cannot readily be obtained even by personal inspection unless one devotes a great deal of time and care to study those features. This is what must be done by those who are specially detailed to carry out the regulations for the care and preservation of our ships, the executive, hull board, etc., but for the other officers and men skeleton models are necessary if they are to know the ship thoroughly. Having seen the skeleton models on board vessels of the German navy, Commander W. H. Beehler, U. S. N., called attention to them while naval attaché and explained the use which the German navy made of these models for instructing the officers and men about the ships in which they were serving. These skeleton models are made of tin and usually on a scale of one quarter of an inch to a foot; they cost, according to the size of the ship, from 2,000 to 10,000 marks, $500 to $2,500, and this money is well invested by an economical administration.

The Bureau of Construction was anxious to have such models, but did not have the money to construct them. But even this sum and ten times that amount would be much more wisely expended for skeleton models than for the ornate models that have been made of all our ships for exhibition in the great expositions at Chicago, Paris, St. Louis, etc., and which only show the exterior appearance of the ships without giving any view of the interior details. How cheaply useful skeleton models can be made has been instructively told by Commander Beehler in the Proceedings of the U. S. Naval Institute, from which publication we abstract the information presented in this article.

Upon his return from duty as naval attaché at Berlin, Vienna, and Rome, Commander Beehler was ordered to the Asiatic Station and took command of the U. S. S. "Monterey" at Canton, China. Shortly after taking command he proceeded with the "Monterey" to Hong Kong, where upon inquiry he soon found a Chinese carpenter whom he engaged to construct a model of the "Monterey" out of wires, paper, and wood. This Chinaman had two assistants who, by taking the blue prints, constructed a complete working skeleton model on the same scale as the plans, one quarter of an inch to a foot. They did all the work on board, as the plans were not allowed to leave the ship. They simply bent a large wire to represent the keel and stem and stern posts, after which they bent wires to shape according to the plans of each frame and secured these wires representing the separate frames to the keel wire and attached the longitudinals in their proper positions. These wires formed the skeleton of the ship. A narrow batten was then secured inside to represent the keelson of a width corresponding to the scale of the depth of the double bottom. The inner bottom was made of cardboard in sections of the interior watertight compartments. The outer skin plating was left off and the spaces along frames were filled in the double-bottom with cardboard representing the bulkheads of the double-bottom compartments. In this manner all the details of the interior of the

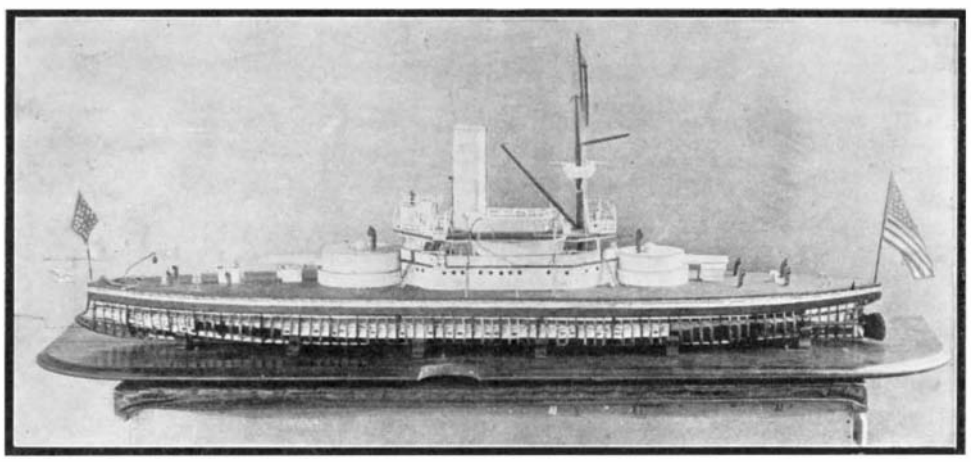


Fig. 1.—The Model Complete.

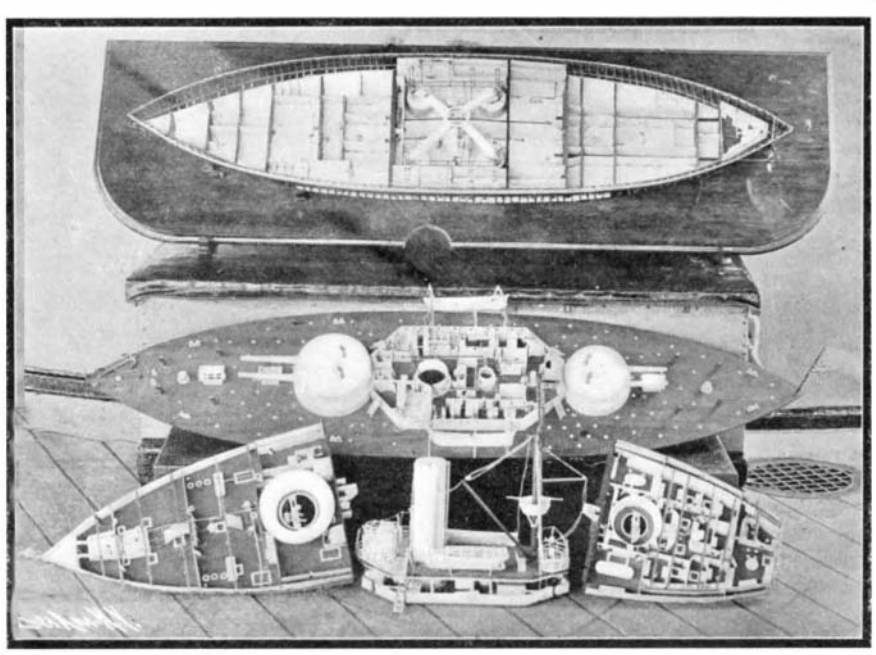


Fig. 2.—Model Dismantled to Show Interior Details.

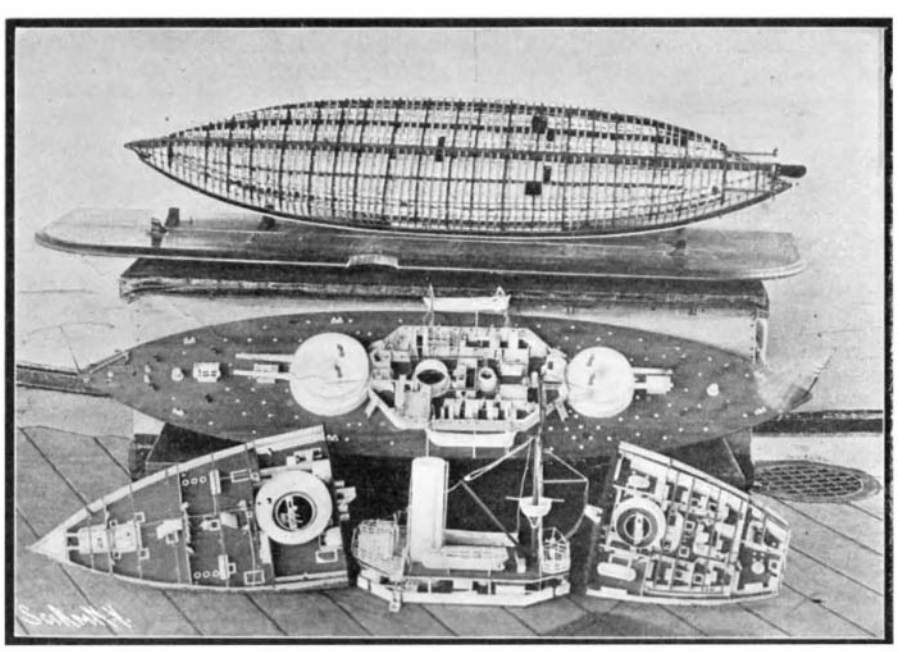


Fig. 3.—A View Showing Double Compartments.

SKELETON MODEL OF THE MONITOR "MONTEREY."

ship were made of cardboard glued in and all exactly to scale.

Wires painted red, green, gray, etc., as adopted in the service, were used in proper places to show the piping, fire mains, and draining system, in the double-bottoms, also the ventilating pipes. All the watertight bulkheads are painted black and all details of the drainage and ventilation of the different compartments and means of access thereto are clearly indicated.

The accompanying illustrations taken from photographs of the model convey a good idea of the scheme as carried out.

The first is a side elevation of the model when assembled. All the essential characteristics of the ship that are given by the expensive exhibition models are hereby shown, besides the side view of the double-bottom, the depth and extent of the armor belt, and the structural support given by the numerous compartment bulkheads constituting the cellular system of naval construction.

In the second figure the model is represented as taken apart to show the interior details. The upper part of this shows the holds, etc., with upper decks removed. The watertight compartments of the holds to the left, showing under the forward berth deck all the arrangements of the store rooms, magazines, etc., next the coal bunkers that envelop the fire rooms and engine rooms. The six boilers, four Ward and two Scotch boilers, are seen in their positions with their uptake connections to the smoke pipe, also pipes that lead to these boilers and to emergency valves in wing passages and above to within the superstructure. The engines are not represented in the model, since on such a small scale the intricate details could not be so well represented and for the practical uses of this kind of a model it was not necessary to go to such details. In fact, other minor details, such as the hand railing around the deck, awning stanchions, some boat davits, etc., are likewise omitted as not being essential to represent; though in the exhibition toy models such details are made as accurately as is goldsmiths' work. In a naval engagement such details would all have to be cleared away, and skeleton models are for practical instruction to enable the personnel to fight the ship most efficiently. Further to the right the store rooms, shaft alleys, magazines, etc., under the after berth deck, are seen, and abaft that the steering engine compartment is seen; this last steering engine compartment also lifts out and shows the trimming tanks beneath.

In the middle part of the view there is the "Monterey's" spar deck with the superstructure deck removed. Here are seen the arrangement of the rooms, the galley, armory, machine shop, offices, etc.

In the foreground there are three sections, the first being the forward berth deck with handling room platform deck. In the center there is the upper part of the superstructure with the two bridges, masts, and smokepipe. To the right the after berth deck, officers' quarters, ward room, and cabin.

The third engraving shows very much the same as the second, except that the upper view represents the ship upside down, reversing the top view of the second illustration. This shows the double compartments, sea valves, and the drainage system, both main and secondary drains being represented by wires.

Such models should be kept on board of the ship of which they should serve as supplementary plans, as did that of the "Monterey." An example of its use will be understood by the fact that when the board appointed by the commander-in-chief of the Asiatic fleet had to consider the question as to a change in the type of the boilers that would be suitable to replace the Ward boilers, they found the model showing the space in the two fire-rooms a valuable guide for them in recommending a suitable type of boiler that would fit. Exact dimensions were of course given, but the model gave solution at a glance and was tangible evidence much better than any other.

The Current Supplement.

The current SUPPLEMENT, No. 1510, contains as its leading article a contribution by the English correspondent of the SCIENTIFIC AMERICAN on the electrification of the North-Eastern Railroad of Great Britain. Excellent pictures accompany the text. In many industries it is necessary to force heavy, viscous liquids through pipes. This involves difficulties not encountered in ordinary pumping, to overcome which two forms of pumps have lately made their appearance. These are described in the SUPPLEMENT. Mr. Clifford Richardson presents a valuable paper on the constitution of Portland cement from a physico-chemical standpoint. His paper will be concluded in the next SUPPLEMENT. M. Emile Guarini describes some very ingenious apparatus for charging and discharging gas retorts. "A New Theory of the Origin of Species" is a subject discussed ably by A. Dastre. The paper on "Current Wheels; Their Use for Lifting Water in Irrigation" is continued. The usual electrical notes and engineering notes are also published.

Engineering Notes.

During the trial trip of the new turbine passenger steamer "Manxman," that has been constructed for the Heysham and Isle of Man service of the Midland Railroad of Great Britain, the highest speed that has ever been recorded by a turbine vessel constructed for mercantile purposes was attained. The "Manxman" is propelled by three Parsons turbines, and in these trials upon the River Clyde the vessel attained a speed of 23 knots per hour. Hitherto steam pressures for turbines have never exceeded 150 pounds per square inch, but on this vessel a steam pressure of 200 pounds per square inch has been provided, and this improvement has resulted not only in the development of higher speed, but in more economic working.

Rapid progress is being maintained in the construction of the bridge that is being thrown across the Zambesi River immediately below the Victoria Falls in South Africa. All the materials have been shipped from England to the point of erection. The bridge consists of a single span of 500 feet, the actual distance from bank to bank being about 600 feet, and the height 400 feet above the river. A special cableway has been thrown across the river for the purpose of handling the material, and construction. The cable is electrically operated, and has a carrying capacity of 10 tons. The work is attended with many difficulties, and the men carrying out the actual constructional work will be enveloped in the penetrating, blinding spray of the falls for eight months. It is anticipated that the structure will be available for traffic, in connection with the Cape to Cairo Railroad, which is now being rapidly pushed forward from the northern bank of the river, by May, 1905.

Another water tower failure has occurred, this time at Cuthbert, Ga. The structure consisted of a tank 20 feet in diameter and 50 feet high, elevated on a 70-foot tower. It was erected nine years ago by a Chattanooga firm. The accident occurred on July 28. The tank was then full of water, and the failure occurred by the bottom dropping out, according to City Engineer Chas. Taunton. The structure was completely wrecked. In a later letter he states that the accident is attributed to failure to follow the plans for the bottom of the tank and to the material used. The opinion of this journal concerning such accidents was expressed so recently that it is hardly necessary to go over the ground again. Elaborate drawings and photographs of towers which have given up the ghost simply befog the real lesson of these accidents. When a tower or tank has to be built the work should not be undertaken by those without experience in structural steel-work and a knowledge of the limitations of shop work. Such information is not secured from wrecked structures.—Eng. Record.

An experiment is to be made in London to ascertain the wearing and durability of camphor wood for road paving. A section of the Buckingham Palace road for a distance of 450 feet is to be paved with this wood. If within four years the new material proves unsatisfactory, it is to be replaced by creosoted deal blocks. This experiment is entirely new, for camphor wood has never been used before for this purpose. The wood comes from East India, and is of a rich brown color and close grained. Trials are also being made with various other woods for this selfsame purpose. The roadway in the Haymarket, one of the busiest West End thoroughfares, is being closely watched. Some eighteen months ago it was laid with four different kinds of wood—boxwood, tallow wood, blackbutt, and algaroba. The first three hail from New South Wales, and the last named from Brazil. All four are just beginning to show signs of wear, though it is yet too early to determine which is the best suited for the purpose.

Superheated steam is now being used with considerable success in Europe for the engines of some of the smaller vessels. Among the most recent examples may be cited some new boats which have lately been constructed in Germany. The Mannheim Touring Company have installed superheaters of the Schmidt pattern upon the sidewheelers "Johannes Kessler" and "Mannheim VIII." two large towboats built at the Berninghaus docks, Duisburg. These vessels are 230 feet long and draw 3 feet of water. The engines and boilers were put in by Escher, Wyss & Co., of Zurich. These are triple expansion engines with three inclined cylinders of 22, 32, and 52 inches diameter respectively and 66-inch stroke. The upper part of the boiler, which is made in two parts, is provided with a set of U-tubes which serve as superheaters. The first trials were made with the boats towing a load of 2,800 tons between Duisburg and Mannheim, and all went very successfully. The indicated horse-power of the engines ranged from 800 to 1,000. Superheaters are also used on the Delphin, of Breslau, belonging to Ch. Wohlheim. They are also of the Schmidt pattern. The boat is a smaller one than the preceding, and has a double helice. It uses about 180 pounds of coal per hour for 90 indicated horse-power. As in the above case, the temperature of the steam is 270 deg. C. The same firm mounted a set of superheaters on a side-wheeler using a 320-horse-power engine. With a temperature of only 250 deg. C., the comparative tests with other boilers using saturated steam showed an economy of 15 per cent of coal in favor of superheating. It is also reported that superheated steam is now being used on the passenger boats which circulate around Lake Leman, belonging to the Compagnie Général de Navigation. These are side-wheelers, and the new system gives much better results than the old.

The Onyx Industry in Mexico.

In the vicinity of Cuernavaca, State of Morelos, Mexican Republic, the well-known winter resort of the Americans living at Mexico city, recently an Aztec onyx quarry has been re-discovered by Carl Ludloff, a geologist living at that place.

Seemingly the quarry has not been used for hundreds of years; it is partly filled up, grown over by brush and grass, but still a slide may be seen on the mountain-side, laid out and carefully paved with smooth stones on which the precious rocks had been brought down to the valley. The quarry shows that it had been worked for many, even hundreds of years.

This old quarry, about 400 to 500 feet wide and long, on the slope of a steep hill, is close to the Mexico, Cuernavaca & Pacific Railroad track, and shows an extensive deposit of a kind of onyx which bids fair to become something quite new and very attractive for architectural and many other kinds of ornaments and a numerous series of implements of different use in the household and arts.

It is a kind of chalcedony. A white, yellowish-gray, or violet core is enveloped by bright red or dark brown concentric strata or layers of different thickness and color. The size of these rocks, which break naturally in cubes or almost rectangular pieces, varies from a few inches up to several feet in diameter. When sawed in slabs, the strata show designs of the most wonderful color and variety; they resemble picture frames, fortifications, the grain of wood, bands or strips of the most variable alternation. Each piece shows a distinctly different design. The stone may be easily shaped to any form and polished. It is softer than flint or quartz and considerably harder than the marble used in the arts.

The "Fool-Killer" and Its Inventor-Victim.

Readers of the SCIENTIFIC AMERICAN will doubtless recall the illustrated articles published in these columns, describing a queer craft which its inventor, Peder Nissen, christened the "Fool-Killer," with a fitness that was prophetic. Nissen started out in his craft on November 29 from Chicago to cross Lake Michigan. He was picked up thirty-six hours later dead—a victim of his own felicitously named invention. A hastily scrawled note conveyed the information that he had been suffocated to death.

A few years ago Nissen went over Niagara Falls in a barrel. For months after that he boasted of his ability to roll across Lake Michigan in a balloon-like apparatus inflated with air and propelled by the wind. He made the attempt last summer and failed. This second experiment proved fatal.

The craft may be described as a canvas bag 30 feet long and 22 feet in diameter tapering to blunt ends which were provided with port holes. Within the bag a shaft extended longitudinally from which braces radiated to stiffen the bag and preserve its shape. Suspended from the shaft between the braces was a basket in which Nissen was wont to take his seat. The craft was steered by sliding the basket from one end of the shaft to the other.

Experimental Electro-Chemistry.

A Practical Series of Papers on Laboratory Practice in Electrochemistry, by N. Monroe Hopkins, M.Sc., Ph.D., Assistant Professor of Chemistry in the George Washington University, Washington, D. C., are appearing every two weeks in the SCIENTIFIC AMERICAN SUPPLEMENT.

The subject of electrochemistry is dealt with from the theoretical and practical standpoints, and the chemist as well as the electrician is taught the art of uniting chemistry and electricity in the modern and rapidly-growing art of electrochemistry.

Although a fair working knowledge of chemistry and electricity must be presupposed in a series of articles on this subject, all abstruse mathematics are avoided, and the subject throughout is treated in the clearest possible manner.

Excellent illustrations accompany each article—illustrations that picture the apparatus and describe processes with clearness.

The North German Lloyd steamship "Lahn," which was sold to Russia early in September, has been reconstructed and will serve as a captive balloon ship. Her mizzenmast has been unstepped to accommodate gas generators, and she has been fitted out with wireless telegraph apparatus and powerful searchlights.

Correspondence.

Massage Treatment for Consumption.

To the Editor of the SCIENTIFIC AMERICAN:

My communications on the subjects of "Immunity from Consumption" and the "Cause and Cure of Consumption," published in the SCIENTIFIC AMERICAN, March 19 and May 21, 1904, respectively, have brought forth so many earnest inquiries for further information in regard to the treatment of this disease—especially massage treatment—that I offer the following additional suggestions.

I do not claim to be familiar with the medical side of the question, neither have I ever attempted to diagnose the condition of the disease in any patient, because such matters belong to the province of the experienced physician. Such information as I have secured has been obtained by practical experience in giving several thousand massage or manipulating treatments to nervous invalids and tuberculous patients, and carefully noting the effect of such treatments on the mental, nervous, and physical condition of each patient. Any treatment which will benefit a nervous invalid will prove equally beneficial to a tuberculous patient, because tuberculosis is made possible only by a weakened or diseased condition of the nervous system.

In addition to the breathing exercises and other suggestions, mentioned in my previous communications, the proper kind of massage or manipulating treatment will prove of great value to the patient.

It is exceedingly difficult for me to write an understandable description of massage treatments. There are many ways of giving such treatments, but I will describe only the most important. In brief, only the balls of the fingers, and the ball (or fleshy part) of the thumb should be used in massaging any part of the body. The touch should be very firm and even, and the movement should be in perfect rhythm, and very slow; no strokes should be given more rapidly than the normal pulse rate, in fact, the best results have been secured by giving strokes of less than one per second. Rapid strokes, given with a heavy pressure more rapid than the normal pulse rate, produce an abnormal pressure on the walls of the veins and arteries, and will cause additional congestion and consequent inflammation of any inflamed parts of the body; but the very firm, slow, and rhythmic strokes will produce no harm under any conditions. Heavy pressure should not be used directly on any part of the body which is sufficiently inflamed to be painful or sensitive to the touch. Treat around the part until the congestion is relieved and the soreness removed.

An ideal massage treatment is one which will secure for the patient all the benefits to be derived from the old forms of treatment, without causing him any pain, or consequent nervous irritation, and without requiring him to use any physical strength to resist the pressure of the treatment, thus enabling him to remain in a *perfectly relaxed condition* during the entire treatment. This can be accomplished as follows: When you are giving the treatment with one hand, the other hand should always be used to provide a counter pressure—no matter what part of the body is being treated—thus relieving the patient from physical strain.

All massage manipulation should be made toward the heart. The treatment on the back should be given by the ball of the thumb, and it should be given the whole length of the spine, placing the left hand on the chest to provide a counter pressure, which will save the strength of the patient. In giving this special treatment, the pressure should usually be from the neck toward the end of the spine, the object being to relax any contracted muscles, and, at the same time, to stimulate and strengthen all nerves connected with the spine. Another very important treatment is given as follows: With the patient lying on his back, use the balls of the fingers only, and with a perfectly even, firm, and rhythmic pressure, massage the entire neck from the spine forward to the clavicle (collar bone), also from the base of the ear down the neck and under the jaw, the object being to stimulate and strengthen the pneumogastric and other nerves leading from the brain and spine which supply the heart, lungs, stomach, and diaphragm with their motive power. This same form of treatment should be continued all the way down the spine, the movements being given from the spine forward and over the sides of the patient.

The external massage or kneading of the bowels should not be given under any circumstances, because such treatments are usually disagreeable and painful to the patient, frequently causing much harm, and in no case can they do much good, in fact, they are unscientific and unnecessary. The question to be considered is not, can the patient stand the pain or nervous irritation of such treatments, but can he afford the loss of nervous force caused by them? In treating the arms and legs, all massage movements should be made toward the body, in order to assist the venous circulation. It has hitherto been the practice to commence with the fingers or wrists, and make the strokes to the shoulders, although some masseurs give one stroke from the ends of the fingers to the wrist, and then from the wrist to the elbow, and, again, from the elbow to the shoulder. I commence at the shoulder, gradually approaching the fingers; also from the thighs, gradually approaching the feet—making all strokes toward the body—thus trying to relieve the valvular or other obstructions in the veins or lymphatic vessels singly, in place of several of them at one stroke—which is impossible.

There may be a difference in opinion about valvular obstructions in the veins and lymphatic vessels, but I know, without a doubt, that this system of treating the limbs improves the circulation of the blood, not only more quickly and more effectively than the old way, but also without irritating the nerves of the patient—thus adding to his comfort and saving his nervous force. If the loss of nervous force makes tuberculosis possible, and if an abundant supply of it will cure the disease, then it is of the utmost importance that we keep that idea in our minds continually, and make it our constant study how both to save and develop the nerve force in the tuberculous patient.

From personal observation, I am fully convinced that the fundamental cause of tuberculosis, or any nervous affection, is the loss of nervous force through irritation of the mind resulting from mental or physical causes; but the first injurious *effect* of such irritation seems to be transmitted to the pneumogastric and other motor nerves, and is usually followed by a corresponding weakness of the lungs, heart, liver, and stomach; but when the roots or base of the pneumogastric and other nerves are stimulated and strengthened by a proper massage treatment, they very quickly commence to recover their strength, and the weakness of the internal organs begins gradually to disappear. This rule, which applies to the lungs, heart, liver, and stomach, also applies to the bowels and all of the internal organs. If you can strengthen the nerve centers and roots of the motor and other nerves which impart life and vigor to these organs, you will find that the unscientific massage treatments—by kneading, twisting, pinching, and slapping—can be abandoned.

It is unnecessary for me to mention the necessity of having a proper diet, plenty of fresh air, and proper sanitary surroundings for the tuberculous patient, because the medical profession, and especially the boards of health of this and other cities, have done splendid work and accomplished wonders in educating the people in regard to the importance of these requirements.

I do not pretend to claim that massage is the only treatment necessary to cure tuberculosis, and, as is well known, medical treatment alone cannot cure it; but I believe that the combination of these treatments, together with suitable diet, pure, dry air, proper environments, and sanitary surroundings—all under the guidance of the experienced physician—can completely master, in its early stages, a disease which has destroyed millions of lives in all parts of the world.

CYRUS L. TOPLIFF,
Member of the National Association for the Study and Prevention of Tuberculosis.
New York, November 24, 1904.

Vacuum Tubes.

To the Editor of the SCIENTIFIC AMERICAN:

The article under the above title by C. M. Broomall in your issue of November 26 recalls an observation made by the writer. One evening a few years ago, after having given an entertainment with Geissler, Plücker, and other vacuum tubes, it was observed that one of the long Geissler tubes, while lying on the table, with connecting wires removed, would light up with a beautiful glow characteristic of that tube, when the hand was moved quickly along its surface. Contact with the glass was not necessary to excite the luminosity, but simply a quick movement parallel with the axis of the tube. When the hand was allowed to come in contact with it, the glow was attracted to that side of the tube which was touched; and when the fingers were applied to the electrode terminals, the glow became much brighter for a second or longer, then gradually died out. Even two hours after having been excited by the static machine, this tube exhibited the glow, though quite feebly. The glow appeared to be excited by induction, and to depend upon a residual charge in the tube.

Like the experiments of Mr. Broomall, this may be a common phenomenon, but many may not have observed it, and many would doubtless be pleased to see an explanation in your columns. W. H. HOWARD.

United States Patent Office, Washington, D. C., November 29, 1904.

An 8-foot steel chimney, 230 feet in height, has just been completed and will be erected in Mexico. This will be the highest steel chimney in America.

A Simple Photographic Method of Reproducing Pictures.

BY CHARLES E. FAIRMAN.

It often happens in the life of nearly everyone that for some purpose a copy of some picture, drawing or manuscript is desired, and the person may not be so fortunate as to own a camera, and may also be entirely ignorant of photographic manipulations. In this process but little is needed in the way of apparatus with the exception of a printing frame, and some of the simpler forms of printing paper such as blue-print paper, self-toning Aristo, or sepia or water developing platinum paper. These papers are inexpensive, and the directions contained with each package are so explicit that the novice can fully understand the manipulation required.

The first requisite of all photographic printing is a negative of some kind. For the purposes of this process we select from our stock of pictures or manuscripts or drawings the subject which we wish to reproduce, and by drawing the picture through a shallow dish filled with melted paraffine the picture is rendered translucent so that it can be used in the printing frame, and from this a negative is made by placing a sheet of some one of the printing papers mentioned with the coated side in contact with the face side of the picture to be reproduced.

With the printing paper printed and manipulated according to the instructions given with the paper, we will have as a result a negative on paper which should be treated with paraffine in the same manner as the original picture. This gives us a translucent paper negative from which any number of positive pictures may be printed.

In preparing the original picture with paraffine, and also the resulting negative, it is important that as thin a coat of paraffine as can be secured should be left on the negative or picture. Thick coating is apt to result in the smearing of the surface when the negative is used in the printing frame, and the smears showing in the resulting print, add a far greater blemish than the original grain of the paper would give.

The surplus paraffine may be removed by placing the picture or negative in the oven, suspended by a small clip. Sheets of blotting paper laid upon an asbestos plate at the bottom of the oven to receive the drippings from the negative should be used. The heat of the oven will cause the surplus paraffine to drip from the surface of the negative, leaving a much smoother surface than can be obtained by placing the negative between sheets of blotting paper and using a hot iron to remove the superfluous coating.

The uses to which this simple method of reproduction can be applied are nearly as varied as the different kinds of drawings or pictures which are of common use.

Combinations of pictures and manuscript may be arranged by using a sheet of vegetable drawing paper as a base and arranging upon this the pictures and manuscript, using a little Canada balsam as an adhesive. From this combination a paper negative with the whole subject matter on one sheet is obtained, and the subsequent steps will readily suggest themselves.

For advanced photographic workers it is suggested that a much softer negative with a lack of sharp harsh contrasts can be secured by this method and for exhibition work it seems to offer possibilities not before recognized.

By the use of rapid bromide of silver paper, prints may be made without the preliminary waxing as above mentioned. The thin sheet of sensitized paper may be laid upon the print to be reproduced with the sensitized side upward, and exposed in the usual way in the printing frame, for a second or two to subdued day light or to an artificial light. It is then removed from its frame and developed and fixed in the dark room. If the subject is a drawing white lines will be reproduced with the figures and letters in the right position against a dark background. Manuscripts may be quickly copied in this way, where the writing is on one side of the sheet, quite perfectly and will show the texture of the paper, including any special water marks.

A discovery of great interest to bakers has been made by an English inventor, Mr. Pickering, whereby the making and baking of bread is considerably expedited. Hitherto the dough has required from four to ten hours to leaven before it was ready. This is a serious disadvantage, for not only does it delay the manufacture of the bread, but owing to the dough being an excellent medium for the culture of bacteria, the longer it remains unbaked, the more bacilli accumulate to help to sour the loaves. By the Pickering process the action of the yeast is expedited, and the dough is ready for baking in ninety minutes. A practical demonstration was recently carried out in a London bakery. After special treatment yeast was added to 28 pounds of flour, and dough made. Fifty-nine minutes after the flour was converted into dough, it had risen sufficiently to be sent to the oven.

THE RACIAL EXHIBIT AT THE ST. LOUIS FAIR.

Several circumstances conspired to make the anthropological exhibit at St. Louis one of the most instructive of the whole Exposition. In the first place, the government put up a commodious building in connection with the United States Indian industrial exhibit, and this formed the nucleus around which were gathered the various Indian tribes with their winter and summer houses, built by themselves and illustrative of the native dwellings before civilization brought its powerful modifying influences to bear upon their lives. The main building crowned the summit of a rounded and sloping hill. In front of it was a large parade ground, in which the most excellent Indian School band played, and where the various exercises of the school were held. Surrounding the parade ground on the three sides were the native dwellings above referred to, many of which were illustrated in our issue of September 24.

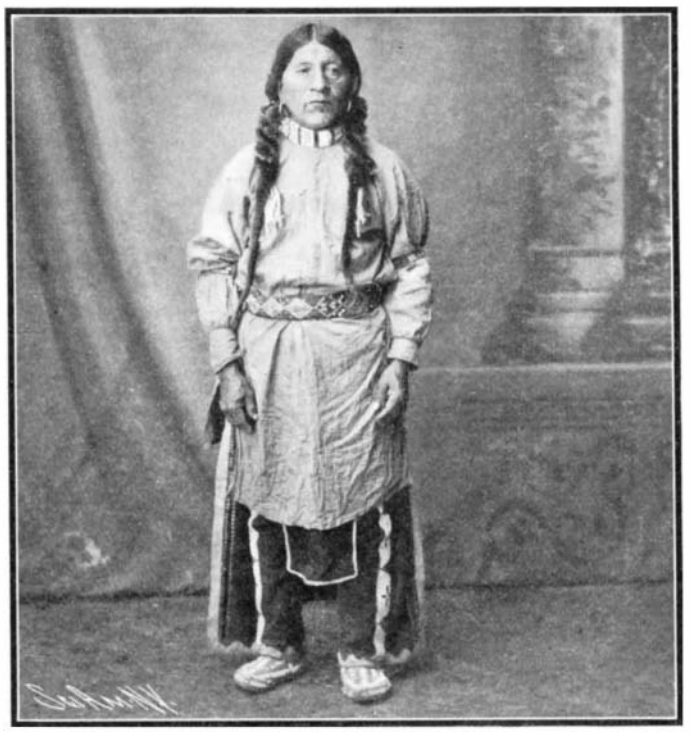
The ground floor of the industrial school was devoted to an exhibit of arts and crafts of the native tribes. On one side the Indians were shown in their native dress engaged in the manufacture of Indian articles of use and ornament. The processes shown were carried out exactly as they were before civilization had taught them new methods and placed new tools in their hands; while on the opposite side of the main central aisle, the children of the native tribes were shown, dressed in modern costume, handling modern tools, and engaged in modern manufacture. First in

(*Continued on page* 414.)

A Cocopa Indian from Old Mexico.

The United States Indian Industrial Exhibit.

Hairy Ainus, the Aborigines of Japan.



A Pueblo Sub-Chief from Santa Clara, New Mexico.

A Pawnee Chief 6 ft. 6 in. Tall and a Sioux Chief.

A Group of Patagonian "Giants."

THE INDIAN SCHOOL AND RACIAL EXHIBIT AT THE ST. LOUIS EXPOSITION.

THE USE OF ELECTRICITY IN DRIVING COAL-CONVEYING MACHINERY.

BY FRANK C. PERKINS.

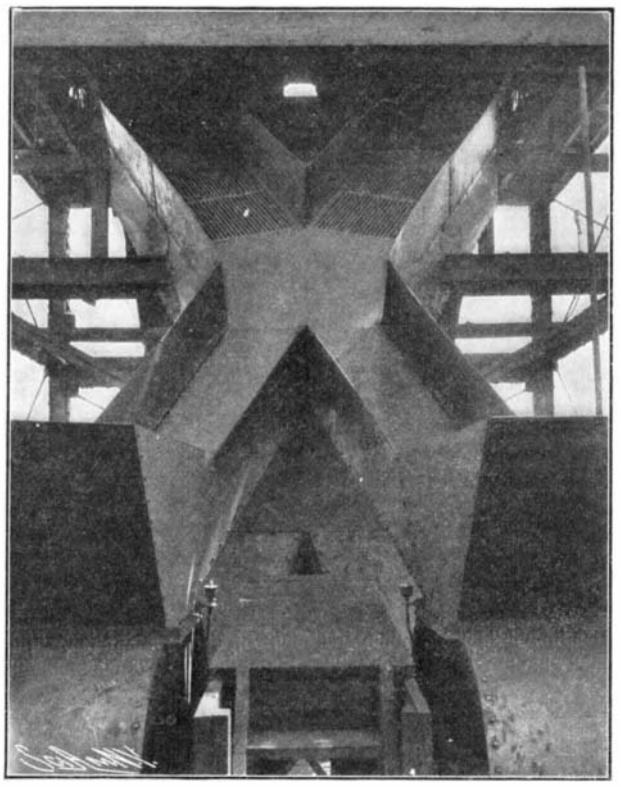
Electric power is now utilized in almost every department of iron and steel plants in Europe as well as in America, giving excellent service and doing work of almost every description with greater economy than it was previously done by other methods. The accompanying illustrations show some interesting features of the electric coal-conveying apparatus at the works of a large steel company situated at Sparrow's Point, Md. One of the largest set of coke ovens in the United States has been recently installed at this plant for supplying the necessary coke for the furnaces. This coking plant has a capacity of ten million cubic feet of gas per day of twenty-four hours, and the coal is handled at the rate of over two hundred tons per hour. The elevators require the greatest power, or about 35 horse-power, and the crushers somewhat less, about 33 horse-power, while conveyors serving the storage bins take about 12 horse-power. The two conveyors take about 25 horse-power, and about 11 horse-power for loading the two reciprocating feeders. The total cost of operating this entire plant has been determined to be somewhat less than two cents per ton of fuel used. The accompanying illustrations give a general view of the 200-coke-oven plant at Sparrow's Point; the inclined suspended light conveyors, which deliver coal to the disintegrators, and the overhead horizontal runs of gravity discharge elevators, from which coal is spouted to the belt conveyor, are noted in detail, while another view shows the two-way chutes from conveyors to disintegrators, which are made with screens through which the fine coal passes directly to the elevators.

One of the four steel-track hoppers is also shown, fitted with a reciprocating feeder, which transfers the coal to the inclined suspended light conveyor; and we also show the chute for heavy gravity discharge elevators to the belt conveyor. The 30-inch distributing belt conveyor is one of the most interesting features of the entire plant. It is of sufficient capacity to transport the coal from both elevators simultaneously, and it fills the bins by means of a reversible automatic belt tripper, the belt being made of woven cotton, which has been found to be very durable. The lower run of gravity discharge receives the coal from the screen bars and disintegrators. A compound-wound motor of 80 horse-power capacity, and operating at 500 revolutions per minute, is utilized for hoisting over the surface of the fuel pile, and the overhead trolley for moving the reloading bucket is driven by a series motor of 50-horse-power capacity and the same speed of operation as the above-mentioned motor.

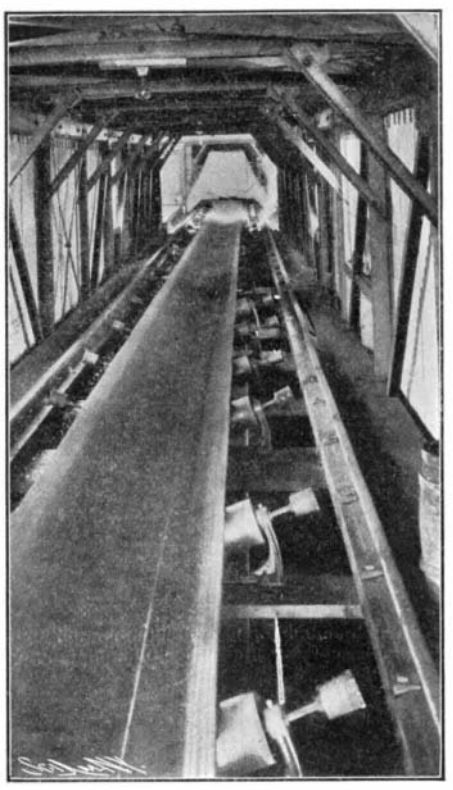
A series-parallel controller is employed for manipulating two 30-horse-power motors, which produce the traverse motion of the swing bridge used for trimming the storage pile. The shakers, which receive the coal from the cars and pass it into the feeding hoppers, are driven by inclosed 5-horse-power motors, while the conveyors running between the hoppers and the crushers are operated by a motor of 25-horse-power capacity, and 50-horse-power compound-wound open-type motors are used for supplying power to the crushers.

Railway motors of 25 horse-power are employed with overhead trolleys to haul the cars serving the ovens to and fro upon the elevated track, the contents of the cars being dumped into the coke ovens by gravity. The endless belt, above referred to, is handled by a 25-horse-power motor, and a 40-horse-power motor of the open type is used for raising each bucket elevator which connects the crushers with the bin-feeding belt.

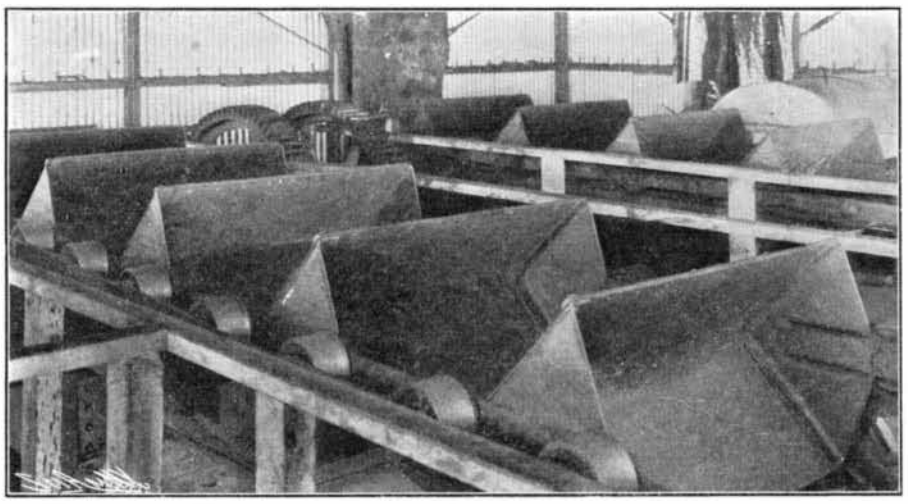
About 1,600 tons of coal is required each day for



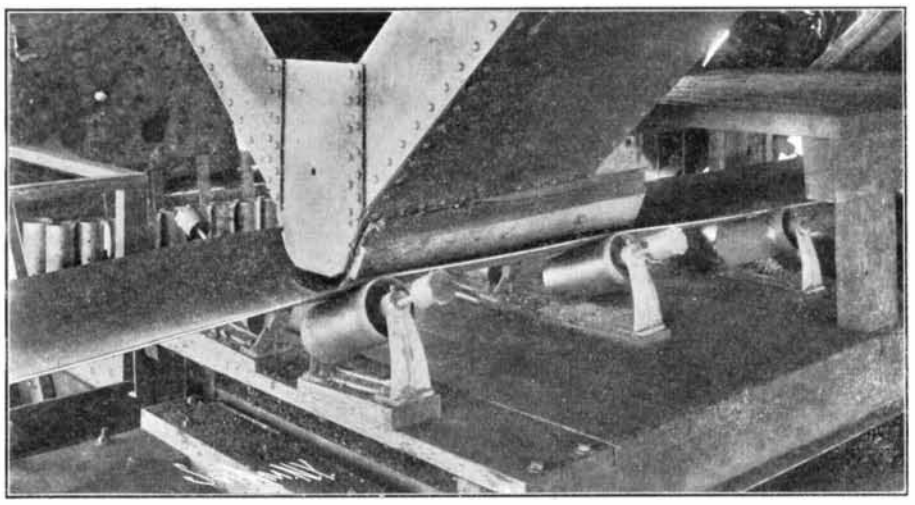
Two-way Chutes from Conveyors to Disintegrators are made with Screen Bars Through Which the Fine Coal Passes Directly to Elevators.



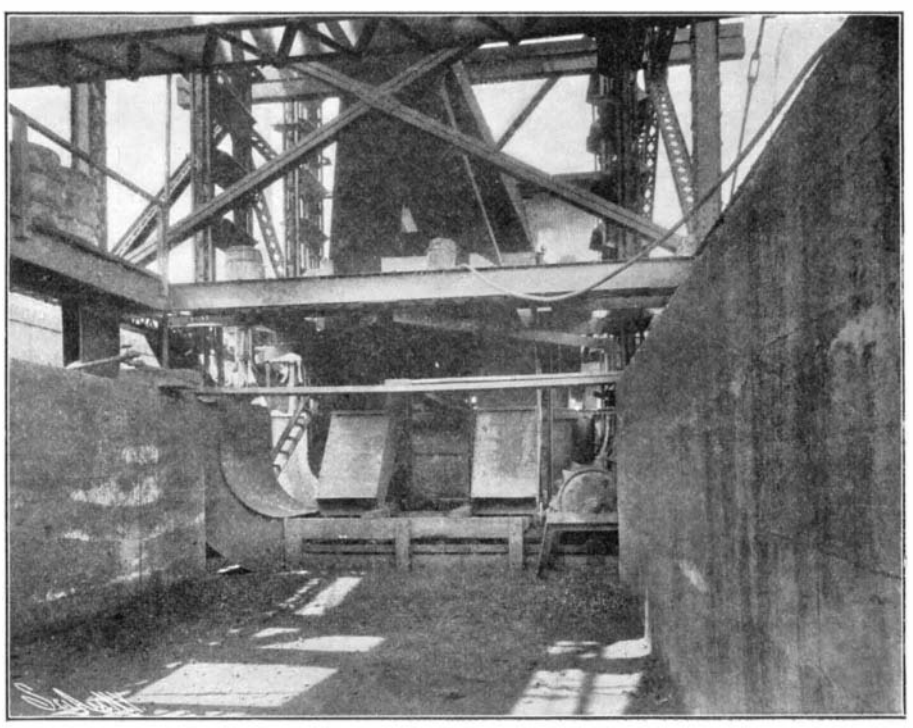
Thirty-inch Distributing Belt Conveyor.



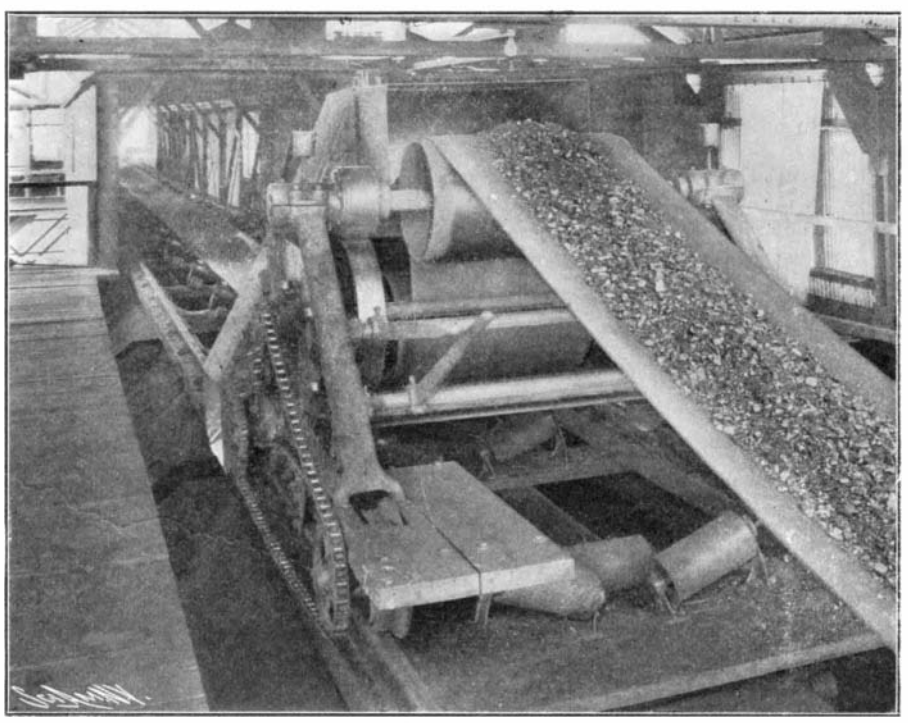
Overhead Horizontal Runs of Gravity Discharge Elevators from which Coal is Spouted to Belt Conveyor.



Chute for Heavy Gravity Discharge Elevators to Belt Conveyor.



Run of Gravity Discharge Elevator Which Receives Coal from Screen Bars and Disintegrators.



Reversible Automatic Belt Tripper.

the four batteries of ovens when all are in operation; and in order to supply the coal as required, there are two 1,000-ton elevated bins provided, and a storage of 50,000 tons, while the coal is all handled automatically, the conveying machinery all being operated by electric power. The fact that the power cost for this work is only a trifle over one cent per ton, not including the manual labor, is ample proof that the electrical system of driving coal-handling machinery is most economical, while the system has shown itself to be more convenient and satisfactory in every way than any method not employing electric power, for doing this class of work.

Anomalies of Ocean Travel.

There have been a number of anomalies this year in the British shipping trade, and one of these is as to emigration and the return of saloon passengers from Europe to the United States. When the cheap rates were established it was the expectation, shared in on both sides of the Atlantic, that there would be a tremendous rush of emigrants from the start, and that these emigrants would be of the lowest and most undesirable character. The facts are that the rush did not take place until late in the season, and the indications are that the total number for this year will be less than for last year (which, however, was an extraordinary year), and the character of the emigrants has not materially changed, nor their status appreciably lowered. For about six weeks the saloon accommodation of all the liners leaving Liverpool (and the same is true as to other British ports, and also the Continental ports) has been unusually crowded. The principal reason for this is that American tourists delayed their departure for home until late in the season, chiefly because the weather over here was very fine all through the summer and early fall.

There are two developments of the ocean passenger traffic, both steerage and saloon, which have not attracted much attention heretofore, and yet which are getting to be important features in the business. The first is the increasing number of citizens of the United States, by adoption, who come over to visit their native land and stay for a season and then return. This has always been the custom of the Scandinavian peoples, but it is also getting to be a growing one among emigrants from the British Islands. The second development is the increasing number of British people, and Europeans generally, who go to the United States, not with any intention of settling, but simply as tourists. It is a common mistake of Americans to suppose that the British people do not travel. As a matter of fact, they are great travelers, but the habit has been to take their holidays either in their own country or on the Continent. Formerly they seldom thought of going to the United States simply for a holiday, but there is a marked change in this regard. Still, on an Atlantic liner, the vast majority of the saloon passengers are Americans and the great majority of the steerage passengers leaving this side are original emigrants.

An Insect Pest.

One of the most terrible of insect pests appears to be the minute black fly of the Mississippi Valley, says the writer of Zoological Notes in Knowledge, commonly known as the buffalo-gnat, from a fancied resemblance in outline to the buffalo, or bison. The buffalo-gnat chiefly attacks the larger kinds of live stock, although it will occasionally bite, and even kill, human beings. In the year 1874 it is stated that in a single county in Tennessee these insects killed stock to the value of $500,000; while within a single week one parish in Louisiana lost 3,200 head of live stock. Horses and mules, during such visitations, are killed while working, or before they can be got under cover when grazing; while in some of the cities on the Mississippi the running of tramcars has been rendered impossible.

Among the new things to be placed in houses of the more imposing character is a combined garbage crematory and water heater. This is in the shape of a small, round stove with a coil of pipe placed in the upper part, and through this a circulation of water is maintained in connection with the regular water supply. A coal fire is kept in the lower portion of the apparatus, and any garbage to be burned is thrown in the top and falls upon the coil of water pipe. The garbage to a certain extent takes the place of fuel and is consumed as such. The moisture of the garbage is driven out by the heat of the coal fire and the residue then burns in the same manner as the fuel and gives out considerable heat.

THE RACIAL EXHIBIT AT THE ST. LOUIS FAIR.

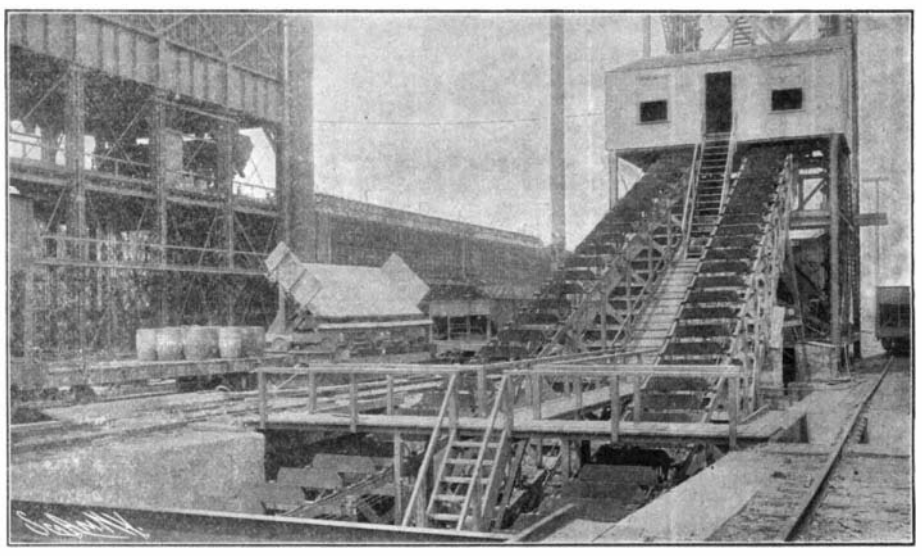
(*Continued from page* 412.)

order were the Arapahoes of old Algonquin stock, engaged in the manufacture of curious symbolic and beaded buckskin articles. In the next inclosure were some Navajo Indians from the Navajo reservation. These were famous blanket weavers, workers in silver and turquoise, and they were seen engaged in the weaving of blankets. Then there was a group of Apache women busy at basket weaving; next some Sioux, skilled decorative artists in buckskin work. On the opposite side of the room to these was the exhibit of the Lawrence Industrial Training School. First there were some students undergoing manual training and learning mechanical drawing; beyond were others engaged in wagon making. Then, in another section, was a complete blacksmith shop, following that a printing outfit in which a daily paper was printed for distribution among visitors. This paper was the journal of the Chilocco Indian Agricultural School, and was published at the school in the interests of the Indian service. Proceeding further down the first floor of the building, on the right, was another group of Navajos engaged in blanket weaving; then a group of Maricopa Indians from Arizona making most exquisite baskets and pottery work, then some Pomo Indians, renowned also for their exquisite basket work. Following them another group of Pomo Indians, makers of stone and shell wampum (money), stone tools, musical instruments, etc., while last and most instructive of all was a room shown by the Chilocco Agricultural School, in which was found a display of native grasses and a model of an educated Indian's farm, with its irrigation ditches and the various crops set out as they would be under actual conditions, while at the back of this model was shown the old Indian home or tepee, set up among the hills near a creek. Under the old native life the Indian went to the water in the hills; under the new he brings down the water by irrigation to himself in the plains. Opposite these displays was a set of inclosures representing the work of the Chilocco Indian Agricultural School. First there was a laundry in which the Indian girls were shown at work with the latest modern laundry appliances; then a kitchen where they were seen engaged in thoroughly up-to-date cooking, and lastly, there was a very dainty dining room set out with its china and glass, the table and furniture of which were made by the Chilocco Indians.

After a stroll through the Indian school and among the native tribes surrounding the parade ground, one was pretty thoroughly saturated with the atmosphere of Indian native and civilized life, and it must be confessed that in passing on around the brow of the hill to investigate other tribal exhibits, one was impressed with the fact that the North American Indian, particularly such splendid fellows as the Sioux, are greatly superior to the average savage tribes of the world, at least so far as they are represented at St. Louis. This is particularly true of the first native tribe encountered after the Indian reservation had been left behind, namely, an exhibit of the pygmies, a black race from the Congo Free State. These diminutive specimens of humanity are intellectually far below the average American Indian. Their faces are coarse, features brutal, and evidence an intelligence of an extremely low order, while of the dignity which sits so splendidly upon the Indian as we know him, there is absolutely not a trace. Three tribes were represented, the Badingas, Batros, and the Bacoubas. One of the pygmies, Otto Bang, twenty-seven years old, looked, because of his small and attenuated stature and beardless face, more like a boy of sixteen or eighteen years. Yet he is a father of two children, and for the visitor who was on the lookout for sensations, he must have possessed rare interest, for the reason that his teeth have been filed to sharp points and have done duty in many a cannibal meal. The average stature of these people is about four feet. Their native houses are made of a framework of flexible bamboo, covered with palm leaf.

Beyond the pygmies was the hut of a group of Patagonian "giants" so called. Although the specimens of these people at the fair were some of them of fair height, they would not by any means pass for giants in America. How the Patagonian race acquired their reputation for giant stature is difficult to explain, except on the hypothesis that the white races of many centuries ago were smaller of stature than they are to-day, and that when the early navigators first saw the Patagonians on their voyages around Cape Horn, they appeared as giants compared to themselves. This suggestion is borne out by the fact that the armor of that day is most of it very small for the average European or American of to-day. In fact, the typical football player of a college team would have to institute quite a lengthy search in an armory collection to find a suit that he could wear with comfort.

For many reasons the exhibit of the hairy Ainus, the aborigines of Japan, was interesting to the average visitor to the fair. This was the first time that these strange people have been represented in America. They come from the far north of Japan, where they engage chiefly in hunting and fishing. Inquiry among the Japanese revealed the fact that even to them the Ainus are a strange race whose beginnings are lost in the obscurity of earlier times. Like so many of the races that were included in this most fascinating exhibit, the Ainus are a very kindly, peaceable, and gentle people, far removed from the typical bloodthirsty savage of childhood's imagination and of much of the juvenile literature of adventure and travel.



Inclined Suspended Light Conveyors Which Deliver Coal to Disintegrators.

THE USE OF ELECTRICITY IN DRIVING COAL-CONVEYING MACHINERY.

Improvements Needed in Torpedoes.

Owing to the success that has attended its utilization in the Russo-Japanese war, the torpedo is claiming greater attention from the various naval powers than formerly. Especially is this noticeable in connection with the British Admiralty. Although the torpedo has proved so deadly, there are two improvements which are urgent: the greater range of the weapon, and greater acceleration in firing rapidly from the tube. The British authorities are carrying out tests with a torpedo 18 inches in diameter, but with an increased range of 1,300 yards, so that it can be effective at 3,300 yards. This increase is deemed to be imperative, not only to augment the destructiveness of the weapon, but to enable it to be effective at a range exceeding that of the small quick-firing arms on the vessels. Owing to the rapidity of the fire of these light weapons, great danger attends the approach of the torpedo boat to the range at which the torpedo is effective, and the risk attending the operation is considered to be too great to compensate for the chance of the torpedo's accomplishing its purpose. But there is a much more important point in course of development. The present speed of firing torpedoes is far too slow. It is contended that what is required is a lighter rapid-firing mechanism than is now employed. Such an improvement would enable the torpedo to be launched from a smaller type of vessel than the torpedo boat, thereby offering a smaller target to the quick-firing guns on the hostile vessel. By increasing the rapidity of fire of the torpedo, its effectiveness could be considerably enhanced, as a far greater number of weapons could be discharged before the fire from the hostile guns became so withering as to compel the retreat of the torpedo craft than is now possible with the existing discharging gear.

Winds and the Temperature.

In an article on the "Temperature of the Air," which Mr. William Marriott, secretary of the Royal Meteorological Society, contributes to Knowledge as the first of a series on "Practical Meteorology," is a summary of the effects of the prevailing winds of Great Britain on the temperature:

N. winds depress the temperature throughout the year.

N.E. winds do the same, except in summer, when their effect is small.

E. winds lower the temperature very much in winter, and generally raise it in summer.

S.E. winds do nearly the same, but less markedly in winter.

S. winds raise the temperature much in winter, but scarcely affect it in summer.

S.W. winds do nearly the same.

W. winds decidedly raise the temperature in winter, and lower it in summer.

N.W. winds lower the temperature generally, but most in summer.

THE ROMAN GALLEYS DISCOVERED IN LAKE NEMI.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The remains of two Roman vessels of unusual size, sunk in Lake Nemi, have been recently brought to light, with the result that much has been added to our knowledge of ancient shipbuilding. Most of the remains have been acquired by the Metropolitan Museum of Art of New York and will be shortly placed on exhibition. Lake Nemi, which lies in the Alban hills to the south of Rome, is a small, beautiful sheet of water a few miles in circumference, filling a basin formed by an extinct crater. From the clearness and smoothness of its water, it was known in ancient times as the Mirror of Diana. Around it were temples and many handsome villas, rendering it one of the most charming sites in the neighborhood of Rome. That a large ship belonging to one of the Roman emperors was sunk in the lake, was a matter of local tradition. Cardinal Colonna in the fifteenth century and others after him succeeded in bringing up a few fragments of a ship. Nothing very satisfactory was done, however, until the Italian government had the present researches made by Sig. Borghi and Vittorio Malfatti. Experienced divers were employed to explore the bottom. Two large vessels were found, one lying near the shore and a second farther out. Both are nearly buried in the sand. The larger vessel must measure 230 feet long and 80 feet center, and the smaller one 200 by 65 feet. Owing to their great size, larger than the usual war galleys, and their exceptional width, they were no doubt used by one of the emperors, perhaps Caligula, as pleasure barges.

Among the pieces which have been brought up so far are a large cylindrical cap of bronze which carries a lion's head (Fig. 1). The whole is cast in one piece, and beautifully worked. This is one of the largest pieces; its height is 12 inches and exterior diameter 17 inches. The lion holds a movable bronze ring in its teeth. The piece formed the top of a wood column, proved by the timber still attached to it. It seems to have been used to hold a rope. The cap was no doubt forced on to the end of the column, there being no trace of nail holes. This specimen has the highest artistic value of any which have been found as yet. Another bronze piece appearing to the extreme right of Fig. 1 was placed on the end of a beam. It has the form of a rectangular cap or box. On the outer side is mounted a wolf's head which is somewhat larger than natural size. The head holds a large ring in its teeth. This piece is of considerable size and measures over four feet in total length. Like the former, it shows no trace of nail holes. Another piece of similar dimensions, appearing to the extreme left of Fig. 1, simulates a hyena's head holding a ring. These two pieces were no doubt placed at the two ends of corresponding beams. Another pair, shown in Fig. 2, have lion's heads mounted on them and must have been symmetrically placed. A piece of remarkable execution is a Medusa's head (Figs. 1 and 2) mounted upon a cap. With the exception of the piece which forms the head of the column, the others all have a rectangular box form with about 0.7 inch metal. The ornamental casting was soldered on to the front. The caps have a somewhat tapering shape, so that they could be easily fitted on. All the heads are of fine workmanship, and must be ascribed to the first century of the Roman empire.

Another fragment of a different kind is a rectangular bronze grating (Fig. 1) with the two side bars which held it in place. The bars have projections on the ends so that they could fit into beams or metal pieces. The grating was no doubt placed horizontally, and held in place by its own weight; there are no holes. Pieces of lead pipe in sections about three feet long were also found. These bear the inscription C. CAESARIS. AUG. GERMANICI, which is the name of Caligula, and the vessels must therefore be assigned to his reign or from 37 to 41 A. D. A great number of tiles about two feet square were brought up. These no doubt formed a pavement for the deck. Quantities of colored strips and different shaped pieces of a vitreous material form part of the collection, together with disks of serpentine and porphyry, which no doubt formed a brilliant mosaic floor. The second vessel yielded great quantities of timbers and a few objects. One of these has the form of a bronze cap (Fig. 1) for the end of a beam, carrying a hand which the Roman vessels bore as a talisman. The pieces which have been brought up, together with the explorations made by the divers under water, give us a great deal of information as to the details of construction of the two vessels, even if we are not able to reconstruct them entirely at the present time. As to the kind of wood which was used, some of it is soft, and the other is harder and more resinous. The soft wood, which was employed mainly for the sheathing and the deck planking, is white pine (*Abies pectinate*) and was no doubt procured on the spot, for splendid trees still grow in the region. The harder wood is either the red pine (*Abies excelsa*) or the larix, it is not certain which, seeing that the wood is greatly decomposed by the water. The harder wood is used mainly for the beams forming the framework. The pins for holding the planking are of oak. The construction of the sheathing of the vessels is quite out of the ordinary. It is formed of planks placed edge to edge and joined by wedges. The planks swell and the edges thus form a tight joint. Another special feature is that the planks are also held together by long copper nails placed at intervals of 4 or 5 feet. The nails pass clear through one plank down to the next one. The succeeding nail is driven through the second plank to the third, and so on. The planks themselves were held to the beams of the framework by shorter copper nails passing through them. The outside of the boat was first coated with a layer of hard plastering, over which was laid a woven fabric. Upon this came a sheathing of lead plates which were held on by flat-headed copper nails about 2 inches long. The use of the lead is not quite clear, as it does not afford a watertight joint and the absence of organisms in the lake does not seem to justify such a protection. Some of the tissue still remains. It is formed of wool and has now taken a dark brown color; the fibers can still be distinguished.

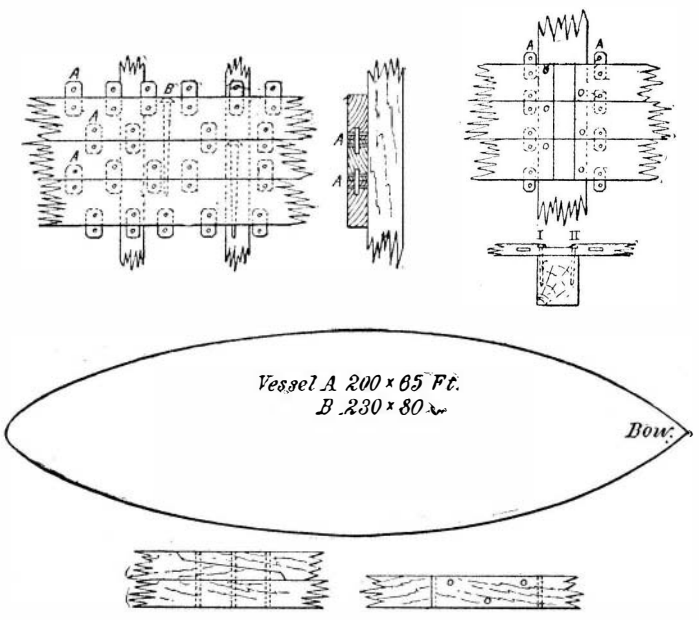


Fig. 3.—Details Showing the Method of Securing the Planking of the Lake Nemi Galleys.

The different beams of the framework are formed sometimes of a single piece and in other cases of two superposed pieces nailed together. The section in the latter case is as high as 10 by 15 inches. To form a long beam, two pieces are often placed together with a parallel joint which is fastened by three large copper nails. Upon some of the main beams are found the attachment points for cross beams at intervals of 12 feet or more. In one piece we clearly see the construction of the deck flooring. It is formed of planks which are fastened on the beam by two nails. We also find the method of joining the planks by clavettes, which run in two rows alongside the beam. Along the top of the planking runs a shallow groove into which no doubt fitted an upright partition. The different parts of the vessel are fitted together in two different ways, either by nails or by clavettes, which are held by oak pins. The nails are mostly of copper (only one of iron was found) and of these great numbers have been brought up and in all dimensions ranging from 20 inches down to 1 inch for the lead plating. The section of the largest nails is nearly one inch on a side. They still bear the hammer marks on the heads. The larger nails must have been made by forging, while the smallest ones were undoubtedly formed by stamping, as in our day. One very peculiar feature deserves mention. On driving in the nails they often encountered an obstacle, such as a knot in the wood, and in many cases they curved around many times in the form of a spiral. Some specimens were found with the ends wound around in five or six turns.

In the project which he submitted lately to the Italian government, Sig. Malfatti proposes several different methods for recovering the entire remains of the vessels. He considers that the best plan would be to drain off the lake and so obtain a ready access to them. The remains are badly damaged, but the larger vessel is best preserved.

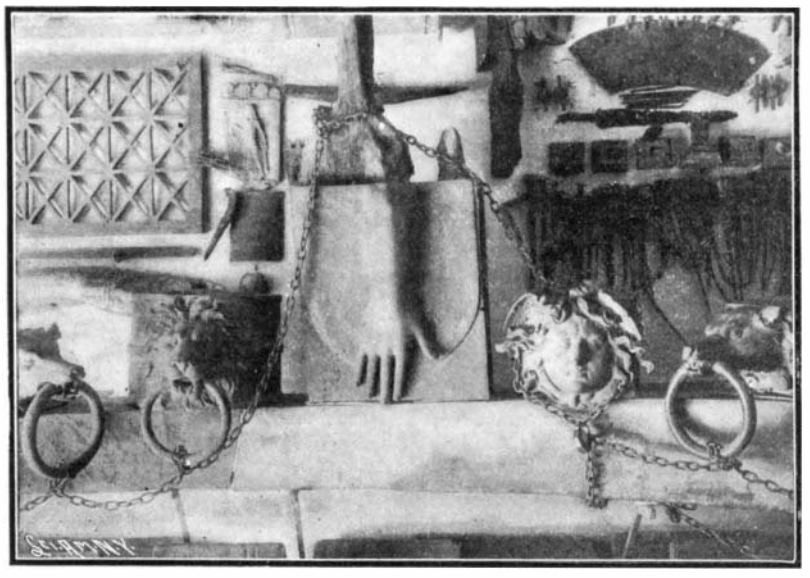


Fig. 1.—The Augural Hand Always Carried by the Roman Navigators as a Talisman.

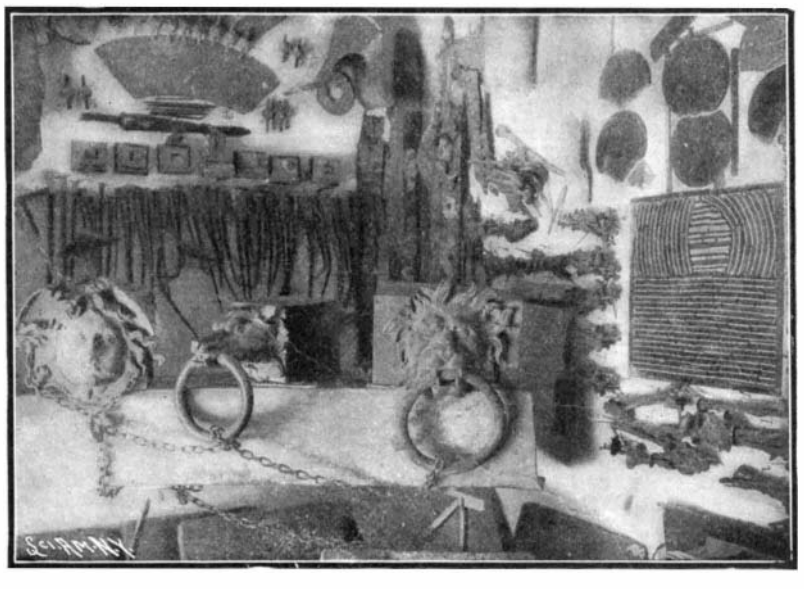


Fig. 2.—Bronze Ornaments for Masts and Anchors Found in Lake Nemi.

A curious development of cinematography is to be undertaken by a London firm. The North German Lloyd Steamship Company have made arrangement for a complete bioscope record of every phase of life, both recreation and work, upon a transatlantic liner. The vessel "Kaiser Wilhelm II." has been selected for the purpose. One of the most difficult phases of the work will be the photographing of the operations in the engine room and stokeholds, owing to the indifferent lighting facilities. For the illumination purposes, however, special electric arc lamps of high candle power will be installed for the occasion, while a special lens, the largest and most powerful that has ever been designated for cinematograph work, will be employed. This lens has a diameter of 3½ inches by 6 inches in length, as compared with ⅜ inch and ⅝ inch, the respective diameter and length of the ordinary type of lens used for this work. The power of the lens will be sixteen times as great as the usual cinematograph lens. The pictures will be taken at the rate of sixteen per second, allowing an exposure of 1-35 second. Two men will be required for the operation, one for the regulation of the focus, and the manipulation of the films, while the other will control the rotating mechanism of the camera. The total cost of this enterprise will be between $6,000 and $7,500.

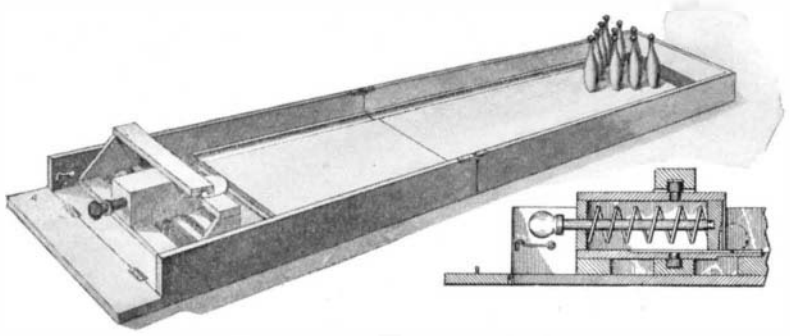
THE ROMAN GALLEYS DISCOVERED IN LAKE NEMI.

For protecting the steel used in the construction of the new coal storage and handling plant at the New York navy yard, the government engineers required that all the structural steel work be given a coat of the best red lead before leaving the shop, all contact surfaces an extra coat before assembling, and after erection two coats of dark green graphite paint.

Patent Department

PARLOR BOWLING ALLEY.

There is always a demand for a good "parlor" game and inventors have found it quite profitable to modify many of the popular outdoor sports and so arrange them that they could be played in the sitting room. An inventor has recently thus modified the game of bowling or nine pins. Bowling cannot be called an outdoor sport, yet it is not a parlor game, because it requires a specially built and expensive bowling alley. To play the "parlor" game, a miniature bowling alley has been provided which may be folded up into small compass and stored away without taking up much room. In use the miniature alley may be placed on any kind of a table. It comprises at one end a device for projecting or shooting the balls at the pins which

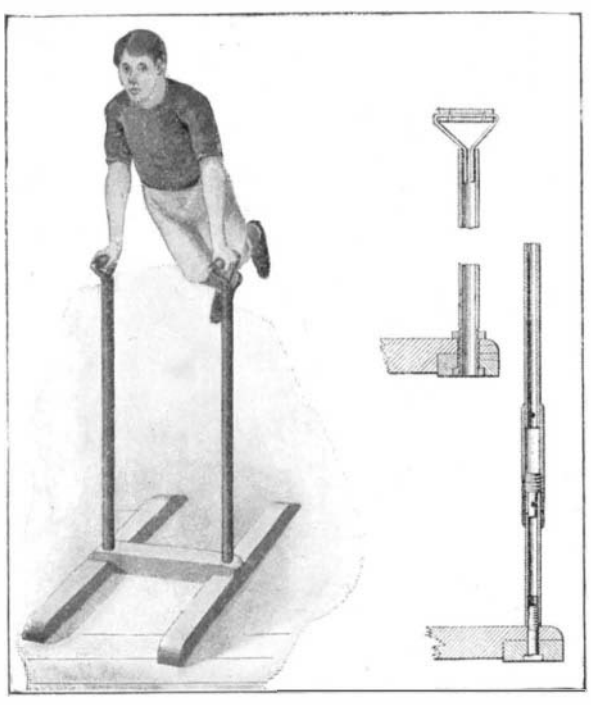


A PARLOR BOWLING ALLEY.

are arranged at the other end. The usual dead runs are provided at the side of the alley; but blocks are supplied with the apparatus for filling up these dead runs, to make a solid alley such as is used in playing the German game of nine pins. The shooting device consists of a casing, open at the front end and fitted with a piston. The piston rod projects through the rear wall of the casing. In operation the piston is drawn back and a ball is fitted into the shallow groove formed in the face of the piston. On releasing the piston it is thrown forward by action of the coil spring in the casing, shooting the ball against the pins. Provision is made for aiming the ball wherever desired. The piston casing is formed with lugs at top and bottom, which are received in grooves cut in two bars extending transversely across the board. This permits the shooting device to be moved laterally to any desired position and it may also be swung on the lugs as pivots to any desired angle. Mr. Robert E. Phillip, of 1709 Pacific Avenue, Spokane, Washington, has just procured a patent on this miniature bowling alley.

IMPROVED EXERCISING MACHINE.

A simple but very useful improvement in exercising machines is shown in the accompanying engraving. The machine, which is in the nature of parallel bars, is so constructed that only two standards are employed, firmly supported at their lower ends. Hand grips are provided at the upper ends of the standards. The hand grips are so constructed that they may be turned in the standards at the will of the exerciser while exercising on the machine, or they may be removed from the standard when not required. At the same time the construction is such that when they are subjected to a direct downward pressure they will remain as stationary as though fixed in the standards.



IMPROVED EXERCISING MACHINE.

The machine comprises an H-shaped base formed of two parallel side bars and a cross bar. The lower threaded ends of the two standards pass through the cross bar and the side bars at their points of intersection, and are provided with nuts, whereby not only are the standards secured to the base, but the members of the base also are firmly bolted together. The hand grips are each formed of flat spring metal bent to a triangular shape with two projecting legs which are fitted into the open upper end of the standard. It will be evident that by this arrangement the hand grips may be readily removed and, when in use, can readily be turned in their standards. This freedom of action permits all the movements practised upon the ordinary parallel bar to be carried out and also a number of movements impossible on the fixed parallel bars. We also show in one of our views another improvement consisting of an adjustable standard whereby the machine may be adjusted vertically within prescribed limits by turning a sleeve which is secured to the upper section of the standard and threaded onto the lower section. The inventor of this exercising machine is Mr. Frederick Bitter, of New York city, southwest corner of 32d Street and Third Avenue.

The electric fan has been a godsend in more ways than one. In the summer months it has been the means of making more tolerable the positions of the men compelled to labor in corners and portions of the office and shop remote from the little air which might find its way into the windows of the place. Besides this it has been the means of equalizing, in a very great measure, the demands made upon the power companies. These fans create a very considerable drain on the product of these companies at a time when there is almost no demand for current for lighting purposes, with the result that the electric generating concerns have found it quite profitable to encourage their manufacture and use. With this in view almost all of the companies in the larger cities keep a number of the fans on hand for rental to their patrons. The latest thing in this line is a tiny construction, which fits in the socket designed for a lamp. This fan is of such simple construction that it costs but little, and is said to be quite effective in scattering the air. With the use of a plug and cord it can be placed wherever desired. It is said to consume only eleven watts, or five of them may be operated with the same consumption of energy as an ordinary 16-candle-power lamp. It is built only for 110 volts, direct current. The fan has an 8-inch sweep, and the blades have a speed of 1,600 revolutions per minute.

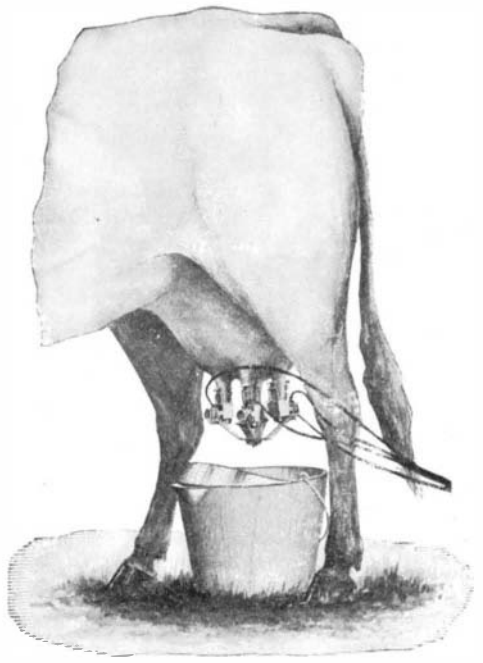
SHEET METAL VEHICLE WHEEL.

The accompanying engraving pictures a vehicle wheel which is made of sheet metal almost entirely. The construction, however, is such as to produce a very strong, shapely wheel which may be used either on a light or a heavy vehicle. The wheel is also so arranged that when in motion it will automatically lubricate the axle-spindle. The hub of the wheel which has the usual external form, is made hollow to receive the box bearing which, in turn, receives and rotatably supports the axle spindle. The space formed between the shell of the hub and the box bearing provides a suitable oil chamber for lubrication of the spindle. The oil passes through a perforation in the wall of the box which may be opened or closed to any extent by means of set-screw threaded through the shell of the hub. On the exterior of the hub two parallel radial flanges are formed to which the spokes are secured. The spokes are made of sheet metal bent to the form of channels of U-shaped cross-section. The flanges on the hub are formed to fit the spokes and consequently consist of series of semi-circular or U-shaped abutments. A pair of clamping rings serve to hold the spokes against these abutments. These rings are formed with radial flanges shaped to correspond with the abutment flanges to which they are riveted at intervals. At their upper ends the spokes are riveted to a U-shaped wheel-rim formed of sheet metal. The rim is braced at intervals by shouldered rivets. The method of joining the ends of the wheel rim is shown in Fig. 3, and consists in riveting the ends to a coupling sleeve inserted in the rim.

In assembling the wheel the coupling sleeve is riveted to one end, but is free to slide in the other. After the tire is shrunk on and the rim thereby compressed to the proper degree, the other end is riveted to the coupling sleeve. Fig. 2 shows a double or reinforced rim which is used for extra heavy work. Mr. John Lefler, of San Bernardino, Cal. (Box 223), is the inventor of this sheet-metal vehicle wheel.

MILKING MACHINE.

A rather novel machine for milking cows has recently been invented by Mr. Victor O. Johnson, of Pawnee, Oklahoma Territory. This machine is arranged to copy as nearly as possible the action of the hand when milking. A brace of four squeezers is provided, each resting in a box and all the boxes secured on a common frame but in such manner that they can easily be adjusted to any cow. Each squeezer consists of two flat spring metal plates connected at the bottom by a

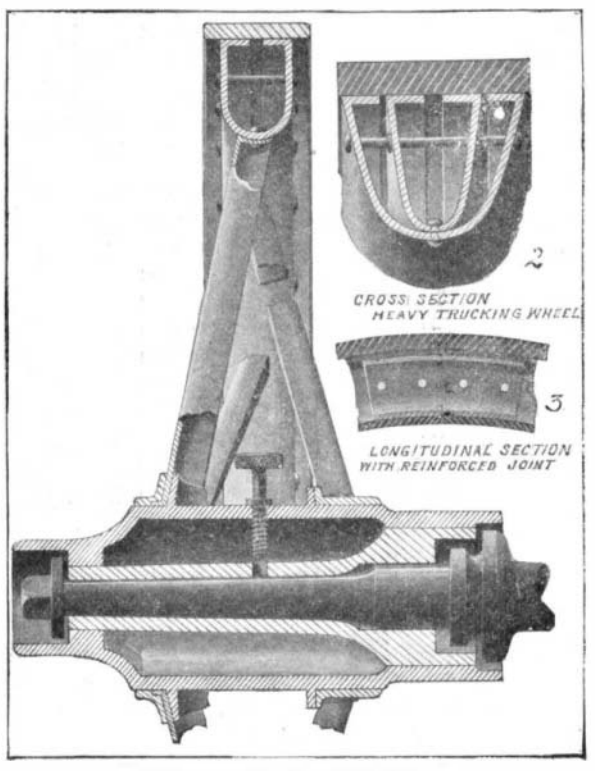


MILKING MACHINE.

U-shaped spring piece and each formed at the upper end with an inwardly-projecting U-shaped bend. These bends are, in operation, adapted to compress the teat at its upper portion to prevent the milk flowing back into the udder while the squeezer plates are moved together. The squeezer plates are provided with a rubber covering formed with ribs at the sides and thus producing channels corresponding somewhat to the form of the teat. The squeezers are operated by compressed air, the outer plate of each squeezer being connected to a piston operating in a small cylinder attached to the box of that squeezer. The plates at each side are formed with pins which project through curved slots in the side walls of the box and are secured to intermeshing segment gears mounted on the box. These segment gears cause the inner plate to move toward the outer plate when the latter is moved inward by the piston, and the pins coact with the curved slots to move the squeezer first upward and then downward while the squeezer plates are still advancing toward each other, thus copying very closely the action of the hand when milking.

Brief Notes Concerning Patents.

The collapsible lifeboat invented by Capt. Valdemar Engelhardt, a Danish sea captain, and which has already been the subject of a brief description in these columns, has recently received the official indorsement of the Board of Supervising Inspectors of Steam Vessels of the United States. This places this craft on the list of those which are recognized and approved for



SHEET METAL VEHICLE WHEEL.

use on passenger-carrying vessels. The tests made for the government officials were very severe. The craft was first rowed up the East River for a considerable distance to try her speed, and then after this was found to be entirely satisfactory, twenty-five men were crowded onto her, and although the boat made use of on this occasion was only twenty feet long, she carried this unusual burden easily. The men were crowded to one side in an endeavor to upset her, but without success. Her cargo was then increased by the addition of 4,900 pounds of stone, which seemed to have very little perceptible effect. The compactness of this lifeboat is another remarkable feature. It is said that four of them can be nested in the space which is usually occupied by one boat.

Some of the European governments, which have at hand the means of making alcohol in large quantities at small cost, have undertaken to encourage the manufacture of spirits. The Emperor of Germany, for instance, has given the matter some considerable personal attention, and has offered prizes for efficient designs of engines and lighting apparatus making use of alcohol. The result has been that great strides have been made, and the new devices are used to quite a large extent. The same thing has been done to a minor degree by the Russians, but it has been discovered to be a lamentable fact that, as the manufacture of alcohol increased, the amount consumed as a beverage also grew lamentably larger and larger. The alcohol habit has taken such a hold on the Russians, that recently the Imperial Minister of Finance offered a prize of 50,000 rubles, which is equal to $25,750, for the discovery of some means by which the alcohol would be rendered so distasteful, that it could not be consumed in this manner. Pamphlets giving the conditions of the award have been distributed among the Russian consuls in the various countries of the world, and it is hoped to stir up a universal interest in the contest.

The Parisian scientist and inventor George F. Joubert has recently announced a discovery which will do much toward making the submarine boat a practicality. This is a means of renewing the air of the interior after the craft has gone below the surface of the water. This is done by the use of a substance called "oxylith," produced electrolytically, which has the power of giving off almost pure oxygen, when pieces of it are dropped into a quantity of water, in much the same manner as carbide of calcium acts under similar circumstances. A plant for the manufacture of the new product has been erected in the Isère district of France, where there is an abundance of water power. While there are many uses for a commodity of this character, its most promising field seems to be that referred to above, and in this connection it is said that it makes available the use of gasoline engines for propelling the boat even when entirely submerged. It is well known that gasoline offers the most economical and convenient fuel, but is only partially available for use on board these boats, because of the fumes which are given off; but with the use of "oxylith," this can be overcome, and the usual battery installation found necessary on these craft for driving while running below the surface can be dispensed with. The Joubert process has been fully described in these columns.

Quite a pretentious factory has been built at Knoxville, Tenn., for the purpose of engaging in the manufacture of several devices, which are to be made under the patents of Prof. Weston M. Fulton, of that city. Prof. Fulton is the local forecaster in charge of the United States Weather Bureau offices and observatory in that city, and by special arrangement with the government he is also instructor of meteorology at the University of Virginia. His invention referred to above has for its object the generation of power from the changes which are constantly going on in the temperature. The essential feature of his invention is the vessel holding the gases and liquids, which are acted upon by the atmosphere. He has designed a metal vessel for this purpose, with deeply corrugated sides, and he claims that this is capable of compression and expansion to a remarkable degree without impairing its usefulness. For the purpose of demonstration, the professor has one of these devices equipped for the work of raising a five-pound weight, which it does in a truly remarkable manner. It is contemplated to make these motors in connection with clocks and bread-raising machines, as soon as the factory is in running order. The clocks will never need winding, and the bread-raising machine will perform its functions in a very reliable manner and without the use of yeast. Public sentiment has of late demanded that bakers depart from the long-established custom of using yeast as a leaven for bread, and the "salt-rising" process is coming more and more into general use. This requires a higher and more uniform temperature, and artificial heat must be resorted to. It is claimed that with the regulator invented by Prof. Fulton, an absolutely even temperature may be obtained at any desired degree. The device is known as the "sylphon."

Legal Notes.

IMPLIED LICENSES AND THEIR LEGAL CONSTRUCTION.—The National Carbon Company, a manufacturer of carbons, employed Clarence M. Barber as a mechanical engineer on a salary. It was part of Barber's duties to devote his time and skill to the improving and cheapening of the process of manufacturing carbon, an essential step of which process was electroplating. While he was thus employed, Barber invented a valuable method for electroplating, and a machine for carrying out this method. He took out patents for both his method and his machine. Under his supervision, special buildings were erected at the works of the National Carbon Company, his employers, to accommodate seven of his machines, six of which were built and installed under his direction, and the seventh of which was installed after his employment had ended.

These were the facts in the case of Barber vs. the National Carbon Company (129 Fed. Rep. 370). The question presented to the Court was this: Had the National Carbon Company any right to use the seven machines which had been installed, and the patented process invented by Barber?

The precise terms of Barber's employment were somewhat indefinite. That his employers knew of his purpose to apply for a patent was most likely. Buildings were especially designed for the use of Barber's process, and apparatus was constructed under his direction, which the court thought were facts sufficient to raise the presumption that he intended to grant to the Carbon Company the right to use his process in connection with the machines, for which space in the several factories had been specially arranged with his knowledge and under his direction. The right of use presumed was the right to use such number of machines as had been prepared for, a right not limited to the life of the particular machine, but including renewals so long as the Carbon Company continued in the manufacture of carbons. The court therefore held that the scope of the implied license included the seventh machine, constructed after Barber was discharged, to occupy the place prepared for it under Barber's direction. His conduct was such in the court's opinion, that Barber had estopped himself from asserting that the use of his invention to this extent was an infringement of his right as a patentee.

ADDITIONS, OMISSIONS AND CHANGES—WHEN THEY CONSTITUTE INFRINGEMENT AND WHEN THEY DO NOT.—John Lenhart secured a patent in 1889, covering an adjustable sliding plate attached by means of a bolt and a slot in the plate, to the inner side of the mold board or share of a plow, to regulate its tilting. The plate described in the specification has a thin lower edge turned toward the share, so that, as it is depressed, it will pass under the edge of the share and cut the roots of grass under the turf. This patent, in an infringement suit brought by Lenhart against the Laurie Implement Company, was held to be infringed by defendant's device, and that decree was affirmed by the Circuit Court of Appeals (130 Fed. Rep. 122).

On appeal, the court held that defendant's device, which consisted of an adjustable sliding plate attached by means of a bolt and a slot in the plate to the inner side of a clip on the inner side of the mold board of a plow, to regulate its tilting, is the mechanical equivalent of Lenhart's device, although its lower edge is flattened in the form of a triangular shoe, so that it will not cut roots, and although it depends by the side of and not vertically under the edge of the plowshare.

This decision exemplifies the well-known principle of patent law, that infringement cannot be escaped by adding to or subtracting from a patented device, by changing its form, or by making it more or less efficient while still retaining its principle and mode of operation, and while attaining the same result by the use of identical or of equivalent mechanical means.

ASSIGNERS AS NECESSARY PARTIES TO AN INFRINGEMENT SUIT.—The McMichael and Wildman Manufacturing Company brought a suit against Ruth, alleging infringement of letters patent granted to Abner McMichael and Frank B. Wildman for automatic rib knitting machines. Among other things, the answer alleged that the plaintiff was not the owner of the entire patent, but that a third interest was owned by Lewis Jones. An instrument was offered in evidence signed by McMichael and Wildman in which they agreed, in consideration of Jones' having improved upon an invention of theirs, to transfer to him a third interest of all the improvements patented thereon, and also to transfer to him a third of any patents which might be issued to McMichael and Wildman in the future, provided that they had been developed at the expense of Lewis Jones. It will be noted that the instrument was wholly executory, that it was not an immediate assignment, but an agreement to transfer. Obviously, the instrument did not convey the legal title to a third of any existing patent. For that reason the court held that the plaintiff could not be required to litigate the question of establishing Jones' interest in this particular patent.

Attacking the question of infringement, the court was not convinced that the presumption of validity which arises from the granting of the patent was rebutted in this case. The defendant contended that the substitution made by the patentees did not require invention. It was a mere exercise of selection wholly within the domain of mechanical skill. If it were true that what was done by McMichael and Wildman did not require invention, but only the exercise of mechanical skill, the conclusion which the defendants sought to deduce from this proposition would, of course, be inevitable. But the court thought the creative faculty of the inventor, not merely the ingenuity of the skilled mechanic, was exercised in producing the patented combination, which was a knitting machine. The art had been already developed; the patentees brought to it nothing of a fundamental character. Nevertheless, in the court's opinion they did, by their improvements, create a construction which had never before existed and which has proved to be commercially successful.

The decree of the Circuit Court was placed wholly on its finding that the defendants had not infringed. But in that view the Circuit Court of Appeals did not concur. The latter court thought that the court below was not warranted in limiting the construction of the claims as it did.

A STRANGE ASSIGNMENT CASE.—The two suits brought by the National Cash Register Company against the New Columbus Watch Company and the Hallwood Cash Register Company, recently decided in a single opinion by the Circuit Court of Appeals (129 Fed. Rep. 114) are curious in more than one respect. It seems that the complainant purchased and took an assignment of an application for a patent which had been pending in the Patent Office for some four years. Six months before the filing of the application complainant had been in negotiation with the applicant and two other persons for the purchase of prior patents for inventions made by him relating to the same kind of machines, and issued to the three. He was then informed of an agreement between them by which, so long as it continued in force, the other two persons furnished the capital necessary to perfect and patent all inventions made by the inventor relating to the subject-matter and were to have an equal interest in the patents as a consideration. As a matter of fact the application bought by complainant covered an invention made under such agreement, and two persons who furnished the capital were each equal owners of a third interest. The Circuit Court of Appeals decided that the facts were such as to put the complainant on his guard and to charge him with notice of all that might have been learned by an inquiry prosecuted with reasonable diligence, and that no title was acquired to the patent subsequently issued which would support a suit for its infringement.

THE POWERS OF OWNERS OF UNDIVIDED INTERESTS IN PATENTS.—The owner of an undivided part of all the rights secured by a patent may without the consent of his co-owners grant a valid license to use the monopoly secured by a patent. A patent secures the exclusive right to use, and the exclusive right to sell the invention it protects. A grant of all these exclusive rights throughout the United States, a grant of an undivided part of all these exclusive rights, or a grant of all these exclusive rights throughout a specified part of the United States, is an assignment of an interest in the patent, by whatever name it is designated. A grant of any interest in or right under a patent less than these is a license.

Such is the monopoly granted by letters patent, that an exclusive licensee for the sale of articles embodying a patented invention or discovery may attach all such conditions as he sees fit to it unless made under his license. A contract may be made, binding a purchaser not to sell for less than a certain named price, nor to any other dealer who does not sign a similar agreement, and making a compliance with such requirements a condition of the license to use or lend the patented article.

The fact that an alleged infringing mechanical device lacks one of the functions of a patented device does not avoid infringement, where such function is not claimed in the patent.

It is a well-known principle in Federal Court procedure that the owner of a patent is not estopped to maintain a suit against the user of an article held to infringe by the Circuit Court of Appeals because of a contrary decision in another circuit in a suit against the manufacturer.—Eldred v. Breitwieser (C. C.), 251.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC HEATER.—E. P. Weggen, Jefferson City, Mo. The invention relates to electric heaters admitting of general use, but more particularly to a type of heater used to a great extent in the boot, shoe, and leather working trades. It is especially valuable for heating burnishing-irons for ironing the bottoms or soles of shoes and boots and for treeing-irons used for ironing the uppers of boots and shoes.

MOVABLE INCANDESCENT LAMP OR GAS-LIGHT HOLDER.—J. H. Stanton, St. Catherines, Canada. Mr. Stanton's invention is an improvement in that class of hangers or holders for lamps which are suspended and adapted to swing or be adjusted in different positions or at different angles. The hanger is adapted for holding a gas-tip at any required angle or position with the same facility as an incandescent lamp.

Of Interest to Farmers.

FRUIT-GATHERER.—J. R. Reid, Vancouver, Wash. With some classes of fruit it is expedient to shake the same from the trees; but the fruit falling on muddy or similar ground is objectionable, because of the washing and cleaning that must follow. The object is to here provide an inexpensive device adapted to be arranged around a tree below the branches and into which fruit may fall and from which discharged into a suitable receptacle. The device may be easily removed from tree to tree, orchard to orchard, and compactly folded when not in use.

FENCE.—H. M. Meinecke, Tomah, Wis. The invention comprises the combination of a post threaded at its lower end, and a base-plate having an opening for the post and provided at its edges with the laterally-extending spur-like arms projecting downwardly at their outer ends and forming extensions laterally beyond the edges of and below the base-plate. The post can be used in any kind of soil and sunk to any depth to prevent leaning and loosening, and used at corners or at intermediate points.

Of General Interest.

MANUFACTURE OF BISCUIT CUPS.—A. Judka, New York, N. Y. The invention refers to cups to be filled with ice-cream, candies, etc., and its object is to provide certain improvements in the manufacture of cups whereby a uniform baking of the biscuit dough in the baking-iron is obtained, a large number of cups are simultaneously and uniformly baked at each operation, and operator enabled to quickly manipulate the baking-iron.

LATCH.—C. H. Blanding, Harvey, N. D. In the present patent the object of the invention is the provision of an improved substitute for ordinary door-latches which shall be simpler, cheaper, stronger and more durable. The latch or latch-bar is constructed of wire bent upon itself and twisted. All parts of the improved door-latch are constructed of wire, so that the device excels in the qualities mentioned above.

AIR-SHIP.—T. C. Benbow, Absarokee, Mont. Mr. Benbow's invention is an improvement in air-ships, and especially in that class which employ gas-bags forming supports for the car, and the invention relates particularly to means for propelling the car in either direction, for causing the same to descend, and for aiding in the ascent of the ship.

FABRIC TRIMMING.—B. Branner, New York, N. Y. The object of the invention is to provide an improved fabric trimming adapted to be converted or made up into different articles such, for instance, as a lady's collar or other neckwear, a bow, rosette, or the like—used on hats, dresses, and other wearing apparel.

CORSET.—E. Savoye, 35 Rue du Caire, Paris, France. In this invention, the main feature of the corset resides in the vertical whalebones, the lower ends of which lie at a certain distance above the lower edge of the corset, and the upper ends lie under the upper edge of the corset and fastening ribbons or similar devices arranged circumferentially on the upper part of the corset. This corset sustains the body, is very comfortable, and the whalebones are arranged to be less liable to break, especially when what are called "spring-steel" whalebones are used.

BILL-FILE.—J. P. Womble, Newport News, Va. The invention is an improvement in that class of files which comprise a pointed pin, a supporting-base therefor, and a tube adapted to slide on the pin and extending the whole length of the same and serving to receive and hold bills and other papers which are removed with it when it is desired to examine them for the purpose of detaching one or more.

GARMENT-FORM.—G. Weant, Mannington, W. Va. The object in this improvement is to provide an inexpensive form through the agency of which a perfect form or model of a person can be produced to serve as a lay-figure on which dresses or other garments may be fitted, and insuring a perfect fit for the person from whom the form was made, thus relieving the person of much annoyance and loss of time in submitting to the usual methods of dress-fitting.

FIRE-ESCAPE.—J. Wenig, Mount Pleasant, Mich. In this instance the inventor's object is the provision of a novel construction whereby the chute may be raised to a window and may be connected therewith in such manner as to afford a means for the safe escape of the occupants of the house. The chute may be of canvas or other suitable material, and has at its upper end a frame by which it may be held open, and handles at its lower end, by which firemen on the ground can hold it in any desired position.

GAS-CHECK.—A. Ullmann, Macon, Ga.—Mr. Ullmann's improvement is in that class of checks in which a pin-valve is employed for regulating the flow of gas. His check obviates well known objections. By employing a plurality of small openings he is able to secure a high pressure of gas and greater velocity of the same, and by using a pin-valve for each port or exit the latter never becomes clogged. The check is practically self-cleaning and never requires attention after installment.

TOBACCO-POUCH.—O. Van Cole, Cripple Creek, Col. Users of tobacco in plug form generally experience inconvenience and loss of time in reaching a knife for cutting tobacco from a plug, and this frequently leads to the practice of persons biting parts of the tobacco from the plug. The object of the inventor is to overcome this disadvantage and to provide means which will enable parts of the plug to be readily and quickly cut and also tend to reduce the evils of biting off parts of the plug.

PROPELLER.—T. G. Thompson, Cambridge, Wis. The inventor seeks to provide a construction which in its operation will simulate closely the movements of a fish in propelling in water, and to this end he makes provision for what he calls the "main" arm, with the outer swinging end of which is connected the blade, so the latter can be swung bodily by the movements of the main arm on its center and also can swing on its pivotal connection with the arm in such manner as to secure a double action in the propeller, resulting from the movements of the arm with the blade and from movements of the blade to a limited extent independently of the arm.

FINGER-RING.—C. Schmidt, New York, N. Y. This invention has for its object the provision of a finger-ring resembling an ordinary signet ring and arranged to provide a locket containing pictures and the like. Pictures, etc., can be readily viewed when swinging the segmental cover into an open position. The cover is not limited to a flat seal portion, and may be arranged exteriorly and of different forms, and ornamented with precious stones and the like.

JEWEL-PIN SETTER.—O. E. Scott, Waterbury, Vt. In this case the object is to provide a setter arranged to insure an accurate setting of the ruby-pin without removal of the roller-table or hair-spring from the balance-wheel to prevent the rim of the wheel from being subjected to heat, and hence injured by the heat employed in melting the shellac used for fastening the ruby-pin in position in the table.

PROCESS OF MAKING HOMOLOGUES OF IONONE.—R. Schmidt, Holzminden, Germany. This application is a division of a prior United States application, filed by Mr. Schmidt. The inventor obtains the pure isomerides, the kind of isomeride obtained depending upon the nature of the acid, those acids which, like concentrated sulfuric acid, exhibit very marked hydrolytic action producing isomerides of the beta series, while the actions of acids such as phosphoric, formic, and the like, the hydrolytic action of which is inferior to that of sulfuric, will not go beyond formation of isomerides of the alpha series. The invention relates to manufacture of alpha and beta ionone.

BEVERAGE.—E. M. Roberts, Atlanta, Ga. The more particular object in this instance is to produce a beverage which simulates the bitter and pungent taste generally found in lager-beers, ales, etc., containing little or no ferment or fermentative product and made without the direct use of alcohol, malt, or hops. It may be dispensed after the manner of soda-water and to some extent used as a medicine.

PASTEURIZING BOTTLED LIQUIDS.—O. Mathie, Wausau, Wis. The inventor provides an apparatus for use in sterilizing bottled liquids, especially beer. In the sterilizing process many bottles burst, entailing more or less loss. Further, in the sterilizing process beer is often so changed as to have a burned or other disagreeable taste, and also objectionable color. By Mr. Mathie's improvement both the above indicated results are avoided with certainty, so that great economy is effected and an improved product obtained.

ADJUSTABLE PIPE-HANGER.—O. C. Meyer, New York, N. Y. The purpose of the improvement is to provide a hanger in which lightness is combined with strength and by means of which pipes may be arranged in series one over or under the other and be placed in parallelism or at angles with each other to each other vertically or horizontally. The hanger is constructed so that it is flexible in its clamping action.

ARTIFICIAL FUEL.—G. K. Hollister, Jr., New York, N. Y. The inventor's process is a simple process free from all those materials that go to make an artificial fuel so costly, thereby placing such processes beyond actual operation, and from demonstrations already given it has been proven that briquets made by his process are as good as the real article. Therefore it is possible by the Hollister process to utilize a large amount of coal waste or screenings and the like, that has always been an undesirable fuel.

HANDLE ATTACHMENT.—W. Chambers, Chicago, Ill. The invention refers to improvements for attaching handles to pots, kettles, and utensils of various kinds. It is especially adapted for use on receptacles which have to be heated and which have a pivoted bail or handle that hangs down in contact with the receptacle while it is being heated. The bail or handle quickly becomes heated when in such a position; and the object is to remedy this undesirable state of affairs.

Hardware.

FOOT-VISE FOR ANVILS. E. M. Cornell, Centerburg, Ohio. The objects of the invention are to secure an arrangement of an anvil with a vise attached, which shall be for general use and of special value in horseshoe-work, such as welding sharp toe-calks. To so construct the vise that it may be very easily and quickly brought into position for use with the anvil and may be swung out of the way when not in use to permit other work to be done on the anvil. To provide a holding device normally open, so that it is always ready for use without first making a superfluous motion to open the jaws.

FLUE-EXPANDER.—J. A. Player, Southern Marine Works, New Orleans, La. Mr. Player's invention relates to improvements in tools for expanding boiler-flues in flue-sheets, the object being to provide a tool adapted to be operated by a suitable motor and by means of which a flue may be quickly expanded to a tight fit in the flue-sheet opening and parallel with wall of the opening.

RIVET.—G. L. Miller, Socialville, Ohio. The invention may be used in every connection to which the ordinary tubular rivet is applied, such as harness, trunk, and certain kinds of shoe work, and upon heavy cloth goods, and the like. It has a smooth head at each side, and is therefore without rough edge to catch or scratch material, the clenches not coming in contact with adjacent surfaces. There is, moreover, no irregular portion for dirt or the like to collect about.

SASH-FASTENER.—J. H. Clements, Coperas Cove, Texas. In this case the improvement relates to sash-fasteners or supports, and is applicable to sashes which are not counterweighted. It contemplates the use of a vertically-disposed rod which is attached to a window-casement, and in connection with this rod a clutch is employed which is attached to the sash. The invention resides especially in the construction of the clutch and improvements in the means for attaching the clutch to the sash.

Machines and Mechanical Devices.

DIE-STOCK.—J. J. Delehant, Chicago, Ill. Mr. Delehant's invention relates to improvements in stocks for thread-cutting dies, an object being to provide a die-stock with a simple means for quickly adjusting it to different sizes of pipes or rods on which a thread is to be cut and serving as a guide to cause a perfectly straight cut of thread.

CONDUIT-THREADING MACHINE.—E. U. Mack, Florence, S. C. In this patent the invention has reference to machines for traversing conduits to effect the drawing in of an electric or other conductor or a cord for attachment to such conductor. The inventor's principal objects are to provide an effective apparatus of this class which will act automatically.

VISE.—E. Clark, Dover, Del. In the present patent the intention of the invention is the provision of a new and improved vise arranged to permit the operator to conveniently and quickly open and close the jaws to firmly grip or release the article while it is undergoing the desired treatment.

GRINDING-MACHINE. D. S. Thompson, Livermore Falls, Maine. The object is to provide a machine more especially designed for the use of manufacturing opticians to permit of grinding cylindrical, toric, and other lenses with the greatest accuracy and producing exceedingly fine surfaces without requiring skilled labor and without giving much attention to machine during the grinding process. The invention relates to grinding-machines such as shown and described in the Letters Patent of the United States formerly granted to Mr. Thompson.

BOOK-FINISHING MACHINE.—F. A. Steele and M. Kalaba, New Rochelle, N. Y. In this patent of the Messrs. Steele and Kalaba the invention has reference to a machine for marking the backs of books with gilt and various other inscriptions, whereby the marking or finishing is performed with mechanical accuracy and much more rapidly than could be done by hand.

SAWING-MACHINE.—J. R. Reid, Vancouver, Wash. The invention has particular application to improvements in a motor-driven drag-saw mechanism. An object is to provide a machine that may be easily carried or transported from place to place over rough and uneven ground, such as found in wooded localities, without the necessity of using teams or consuming time in clearing a path for passage of the machine through the woods. Further, to provide a novel machine, the saw whereof is designed to be driven by a suitable engine or motor mounted upon the frame.

PACKAGING-MACHINE.—A. McLeod, and J. H. McLeod, Marietta, O. In this patent the inventors have made certain improvements in packaging-machines, and especially in force-feed devices for flaked or powdered material. The present invention is especially adapted in handling flaked goods, such as rolled oats, for which work the machine has proved very satisfactory.

WINDMILL-PUMP COUPLING. — C. W. Decker, Charles City, Iowa. The object here is to provide means of coupling the hand-lever of the pump to the pump-rod, at the same time uncoupling the windmill-rod from the pump-rod and *vice versa*. Means for obtaining this are embodied in a device attached to a special form of windmill-rod, all apparatus for coupling and uncoupling being contained in this pump-rod with its attachments. The device is practical and extremely convenient in that the pump-rod may be placed in the pump, replacing the original pump-rod, and after attaching the device by certain means the apparatus is ready to be used.

LEADING ATTACHMENT FOR TYPE CASTING AND SETTING MACHINES.—S. Drummond and W. C. Lieberknecht, New York, N. Y. The invention refers to improvements in leading attachments for type casting and setting machines, and particularly to the so-called "monotype machine," the object being to provide a device by means of which leads of any desired size will be automatically fed between the lines of type as composed, thus not only expediting the setting up of matter, but resulting in a uniformity of work.

MACHINE FOR MAKING TUNE-SHEETS OF MUSIC.—N. Collins, 22 Grays Inn road, London, England. As usual with tune-sheets, notes are represented by perforations in the sheet, there being a line of perforations corresponding to the notes of each pitch in the scale, the length of the several perforations and of the intervals separating them representing the length of the respective notes and intervals in the piece of music to be reproduced. The invention relates to improvements in machines for making "note" or "tune" sheets which are used in connection with automatically-played instruments.

STREET-SWEEPER.—A. Brown, Plainfield, Ill. Mr. Brown's invention relates to sweepers of that class which take up and collect dirt gathered from the street and retain it in dirt receptacles which are removable from the sweeper and designed to be loaded onto a separate vehicle to be carried away to the dump, so that the sweeper itself may be kept continuously at work. A former patent granted this inventor is a sweeper of this type, and the present comprehends features by which the machine sweeps cleaner, operates closer to curb, and is rendered more compact and stronger.

BLUE-PRINT MACHINE.—H. A. Buchholz and E. J. G. Rademacher, New York, N. Y. The purpose here is to provide a form of machine especially adapted for making blue prints or photographic prints from tracings on transparent material or drawing-paper adapted for the purpose, and to so construct the machine that properly-prepared paper in reel form is protected from light and held in revoluble manner in machine in suitable receptacle and means for feeding the prepared paper in connection with the tracing-cloth or other material from which a print is to be made beneath a transparent pane which will uniformly hold the sensitive paper and cloth containing designs to be copied in smooth, close relation to each other.

Prime Movers and Their Accessories.

ROTARY ENGINE.—W. Beaumont, Granite, Oklahoma. Mr. Beaumont's invention refers to improvements in rotary engines, an object being to provide an engine of this type so constructed as to be evenly balanced while running and which may be operated with an economical use of steam. The body of the engine is cast in four parts, suitably bolted together, and is therefore comparatively cheap to manufacture and assemble and is easily trued or turned up.

CONTROLLING AND GOVERNING GEAR FOR PRESSURE-ENGINES.—E. Crowe, Bircholm, Bushey Wood, Totley Rise, Sheffield, England. Mr. Crowe's invention relates to the controlling (including the starting, stopping, and governing) of steam and other pressure engines, and has the twofold object of reducing to a minimum the manual labor required to adjust the controlling device and of automatically regulating during the running of the engine the supply of steam or other motive fluid according to the amount of load for the time being on the engine.

EXPLOSIVE-ENGINE.—R. Miller, New York, N. Y. In this case the invention relates to an engine of simple construction and great thermodynamic efficiency. This efficiency is obtained by an initial pressure of high intensity, due to thorough scavenging and to a complete expansion and utilization of the explosive charge.

RELIEF-VALVE FOR LOCOMOTIVE-CYLINDERS.—F. L. Robinson, Cheyenne, Wyo. The improvement made by this inventor has reference to relief-valves, and more particularly to a type of such valve suitable for use upon locomotives to enable the engineer to vent cyl

inders at will and also to remove the water of condensation as fast as formed while the engine is not in motion.

Pertaining to Vehicles.

SPRING-SLEIGH. W. C. PROUTY, Wayne, Mich. The principal object of this improvement is the provision of a sleigh in which the body is supported upon a spring structure of novel design which may be applied to a sleigh running-gear of ordinary construction and which is so constructed that it may be connected with the sleigh-body and running-gear in such manner that no rattling will result and there will be but little tendency to loosen the spring connections.

AUTOMOBILE ATTACHMENT.—J. B. MOTT, Fredonia, N. Y. Mr. Mott's invention has reference to an attachment for automobile-decks adapted to be placed in position when the tonneau or rear seat of the machine is removed. By means of the inventor's improvement a storage-chamber of greatly increased area is provided and the appearance of the vehicle is very materially enhanced.

AUTOMOBILE DRIVING-GEAR.—G. C. CANNON, New York, N. Y. This invention relates to differential gear and appurtenant parts of a motor-vehicle. The differential gear is located directly in the crank-case of the engine and driven by a direct connection with crank-shaft. The divided transmitting-shaft passes from the gear and is joined by Cardan or equivalent flexible connections with short shafts mounted, respectively, in the sides of the vehicle-frame, which shafts in turn have suitable connections with the driving-wheels. Thus a more compact, reliable structure is produced, and by peculiar arrangement of shaft-sections and cardans unavoidable "working" of frame affects not the easy movement of driving parts.

Railways and Their Accessories.

FREIGHT-HANDLING APPARATUS.—F. B. HEWITT, Fort Myers, Fla. Apparatus for loading and unloading railway-cars, vessels, and the like is improved in this invention, the object of the inventor being to provide a device by means of which freight may be rapidly and safely handled. If desired, freight may be both loaded into a car and the same time freight discharged therefrom or the carriers may leave the car empty, to be provided with freight or other material arranged alongside the main frame.

SPIKE.—J. B. ANDERSON, Portland, Ore. Though applicable to other purposes in the arts this improvement has reference more especially to railroad-spikes, and one of the principal objects of the invention is to provide a device of this kind which is thoroughly effective and reliable in use and one which may be easily driven into place and again withdrawn, besides possessing the capacity for long and continued service.

CATTLE-GUARD.—J. F. WOODIN and F. H. WOODIN, Lexa, Ark. This invention has for its object to provide novel details of construction that afford a guard which is very simple, durable, easy to place in position and remove, and that very effectively guards a railroad track against the travel thereover of horses, cattle, or other beasts in either direction. The guard may be moved from one point of a railroad to another and be readily placed in position without requiring any material change in the road-bed, other than to excavate trenches for the reception of the troughs. Inclination given sides of troughs correspondingly increases area of contact with road-bed, and insures stability when in position.

BRAKE-RIGGING.—J. M. DAVIES, JR., Plattsburg, N. Y. This inventor's objects are attained according to the embodiment of the improvement by a connection which contracts automatically, taking up the slack as it occurs and coacting with a brake-lever restrainer which is automatically shifted as the brake-rigging becomes slackened and which limits or restrains the movement of the brake-rigging within the proper throw. The invention relates particularly to the brake-rigging of freight-cars, although useful in other connections.

HAND-BRAKE.—H. B. VICKERS, Schenectady, N. Y. The object of this invention is to provide a brake, more especially designed for use on street-cars and similar vehicles and arranged to permit the operator to powerfully and quickly apply the brake and hold it applied without the operator being required to manipulate locking devices and to allow quick release of the brake whenever desired.

Designs.

DESIGN FOR TRIMMING.—A. M. WEBER, New York, N. Y. In this highly ornamental design the ladies' collar or dress trimming has two thickened rims or edges duly spaced apart and connected by chiffon or bolting cloth. Fagoting covers and extends inward from the outer side of rims, and to the inner edges of the fagoting an ornamental cord is attached, having a series of loops that extend across the chiffon, while another similar cord extends sinuously between the loops and along the longitudinal center of the collar or trimming.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

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Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6258.—For a machine for tying up box shooks in a factory.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6259.—For manufacturers of machines for cutting tobacco, as well as for making cigars and cigarettes.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 6260.—For manufacturers of household utilities, suitable for the mail order business.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6261.—For makers of power corn shellers and grinders of capacity of about twenty-five bushels per hour; also for makers of power grinders for dry bones and oyster shells.

Perforated Metals. Harrington & King Perforating Co., Chicago.

Inquiry No. 6262.—For manufacturers of blue steel enamel signs and white enamel letters for window signs on glass.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6263.—For manufacturers of hand power paint mills for grinding white lead in Japan.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6264.—For manufacturers of nickel and electro-plating apparatus.

WANTED.—Patent attorney to sue for infringements on commission basis. X. Y. Z., Box 773, New York.

Inquiry No. 6265.—For manufacturers of brushes of medium grade, wooden back and stiff bristles.

FOR SALE.—Patent No. 699,855. Universal pocket measure. J. F. Steckenrecter, 538 W. 58th St., N. Y. City.

Inquiry No. 6266.—For a machine to strip the bark off a shrub.

We manufacture tripoli stones of all dimensions, disc, cylinders, etc., samples free. Seneca Filter Co., Seneca, Mo.

Inquiry No. 6267.—For manufacturers of handles for shaving brushes, particularly those made of bone or composition.

Glass preserving company, organizing, will issue stock in payment for glass machine or jar patent. Valuable, Box 773, New York.

Inquiry No. 6268.—Wanted, a complete mattress and carpet renovating outfit, for starting a mattress factory.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 6269.—For makers of electric motors for direct current, for limited field, armature only having small number of coils.

Sheet metal, any kind, cut, formed any shape. Die making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 6270.—Wanted, names and addresses of manufacturers of arsenical sheep-dips.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 6271.—For parties engaged in printing on glass with rubber type, and otherwise, also for parties who print on celluloid with black printers' ink.

LIVE MAN WANTED.—If you have $5,000 and want $1,000 yearly in manufacturing business. Big demand, no competition. Write Manufacturing, Box 773, N. Y.

Inquiry No. 6272.—For manufacturers of mattress-making machinery.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6273.—For makers of tubes or pipes for musical chimes.

The SCIENTIFIC AMERICAN SUPPLEMENT is publishing a practical series of illustrated articles on experimental electro-chemistry by N Monroe Hopkins.

Inquiry No. 6274.—For manufacturers of machinery for making wooden toothpicks and clothespins.

We manufacture gasoline motor and high-grade machinery, castings best quality gray iron. Select patterns, and let us quote prices. Frontier Iron Works, Buffalo, N. Y.

Inquiry No. 6275.—For manufacturers of storage batteries.

AUTOMATIC (CARPENTER'S) HAMMER DEVICE.—U. S. patent No. 726,466 for sale. Send for descriptive circular with cut. Any reasonable proposition considered. No brokers or agents. Geo. H. Rowe,, L. Box 442, Ennis, Texas.

Inquiry No. 6276.—For manufacturers of bench motor grinders.

WANTED.—An estimating clerk. Must be competent to figure with accuracy time and material on plate work, tanks, boilers, castings, etc.; no one need apply except an experienced man. Address Broomell, Schmidt & Steacy Co., York, Pa.

Inquiry No. 6277.—For machines for making paper bags.

Inquiry No. 6278.—For makers of machinery for making nut food product and extracting of oil.

Inquiry No. 6279.—For manufacturers of an apparatus for distilling water.

Inquiry No. 6280.—For manufacturers of dish-washing machines.

Inquiry No. 6281.—For dealers in all kinds of machinery pertaining to paper making.

Inquiry No. 6282.—For manufacturers of machinery for making paper car wheels.

Inquiry No. 6283.—For manufacturers of programme clocks, for school and college use.

Inquiry No. 6284.—For makers of machinery and materials for the manufacture of brooms, candles and soap.

Inquiry No. 6285.—For a neat eyelet and fastener for same, for fastening the two sides of a small leather pocket book.

Inquiry No. 6286.—For manufacturers of electrical devices and novelties.

Inquiry No. 6287.—For small refrigerating machinery for private use.

Inquiry No. 6288.—For parties to manufacture, in quantities, a small cast iron fixture, as follows: To be first turned into malleable iron, then copper plated and finally nickel plated.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9489) G. C. asks: 1. What is the cause of the slight snap which is heard at the poles of an electro-magnet when the circuit is broken? I observe that it seems louder when the poles are close to a large mass of iron. A. The sound heard at the instant the current is broken through an electro-magnet is called the "magnetic click." It is caused by the demagnetizing of the molecules of the iron core. The theory is that the particles of unmagnetized iron or steel stand in all possible positions in the bar. Magnetization consists in setting these particles so that their axes are in the same direction; demagnetization deranges them again. A click is heard both when the bar is magnetized and when it is demagnetized. 2. If matter is considered as composed of molecules with relatively large spaces intervening, how can it be explained that certain solids, even in very thin sheets, can completely bar gases and liquids under pressure from passing through said spaces in their substance? A. All solids, when in sufficiently thin sheets, allow gases to pass through the spaces between their molecules. That some require to be made thinner than others may be explained on the supposition that the molecules of such solids are nearer together than those of others which permit transfusion easily. 3. In a gas engine, what percentage of the heat of combustion escapes with the exhaust gases? What portion through the cooling circuit? A. The heat losses in a gas engine vary greatly with the heating power of the gas and air mixture; the compression as well as the proportions of the mixtures, and the working temperature of the cylinder, as indicated by the volume and temperature of the cooling water passing through the cylinder pocket. In good practice the loss by the exhaust is about 40 per cent, by the water jacket about 30 per cent, leaving the total efficiency about 30 per cent. 4. Does the operation of compressing the explosive mixture in an engine consume any of its power? A. Compression would be a loss if not for the effect of combustion, which expands the compressed charge, and thus increases the effective pressure and the efficiency of the engine. 5. Is the compression made only in order to get a larger amount of fuel into the clearance space? A. Compression increases the density as well as the volume of the charge at the moment of ignition, and therefore increases the pressure far more than the amount of compression. 6. The electric current is spoken of as flowing at a certain rate. Has "rate" here any reference to the *speed* of the particles of electricity? Is not the speed of current practically that of light, whatever the conditions? A. The electric current cannot be correctly spoken of as flowing at any certain rate or velocity. Its velocity depends upon the capacity of the conductor and other conditions. The propagation of electric waves in the ether is quite another matter. These have doubtless the velocity of light, which, according to the present belief of scientists, is simply an electro-magnetic phenomenon. 7. If the charge on electrons is simply static electricity, how can such charge be affected by a magnetic field, as is seen to be the case? No such effect on a charged pith-ball is producible. A. An electron is a particle moving under an impulse and carrying a charge of electricity. Electricity is static when it is in the condition of a charge, as on a pith ball, or on the plates of a condenser, or at the ends of conductors, when its further motion is impeded. If now this charge becomes able to fly off into space, its streaming particles are affected by a magnetic field, and the stream is deviated from its direct path. See the experiments of Maxwell, Crookes, Hertz and others. 8. Does the striated appearance of an iron filing diagram of a magnetic field indicate that no magnetic force is present in the spaces between the lines of filings? Or is the space within the field completely occupied and filled by the flux, as a cup is filled with water? A. The arrangement of the iron filings in lines, with intervening vacant spaces, has given us the conception of space as occupied more or less fully by lines of force. Lines of force are simply a convenient supposition to convey the greater or less intensity of electro-magnetic action within a certain area. The flux may be considered as distributed uniformly through the space, as the molecules of water are in a cup; but not as completely filling the space, any more than do the molecules of water in a cup. These do not fill the cup. However, no more water can under constant conditions of temperature and pressure be put into the cup, while more lines of force can be made to pass through the space. There is thus both a similarity and a difference between the two. 9. Is an induced E. M. F. due primarily to the *cutting* of lines of force, or merely to the change in the number of them passing through the circuit? In the transformer with closed magnetic circuit, it would seem that the flux from the primary, following the iron ring, would simply pass through the secondary coil from end to end, and no lines would cut across the wires, yet a great E. M. F. is caused. A. An induced current is set up in a *closed* conductor when the number of lines of force which it incloses is made to increase or decrease. In the case of the transformer with closed magnetic circuit, the lines of force pass through the convolutions of the wire and around, completing their circuit on the outside of the convolutions of the wire. It is by the varying of the number of lines that the E. M. F. is produced. The variation is incessant by reason of the alternations of the primary E. M. F. This you seem to have overlooked. 10. Can an electric discharge pass across a space completely devoid of matter, however great the potential? If not, why is it that the nearer this condition is approached in a vacuum tube, the less force is required to pass the discharge through? A. A perfect vacuum is not a conductor of electricity. Vacuum tubes can be exhausted till no discharge will take place through them. It is not true, as you state it, that less force is required to pass the discharge through a high vacuum than through a lower one. When the vacuum is higher than a millionth of an atmosphere, it is very difficult to force the discharge through it. 11. Do any of the radium rays *directly* affect the eye as light? A. Radium does not directly produce the sensation of light in the eye. By some it is thought to produce a fluorescence of certain of the media of the eye, and thus indirectly cause a sensation as of light. 12. Can any electricity, however great the tension, pass through chemically *pure* water? Can it pass through any fluid except the metals without causing decomposition? A. Chemically pure water is to be classed as an insulator; but an insulator may have electricity pass through it, if the pressure of the electricity is sufficient. All electrolytes are decomposed by the passage of electricity, but all electrolytes are classed as conductors, better or poorer. All your electrical questions would be resolved more satisfactorily by the study of good books, than by the brief replies in our columns. Thompson's "Elementary Lessons," which we can furnish for $1.50, explains most of them. 13. I have been told that a bicycle tire when tightly inflated is less liable to punctures than when softer. If so, why is this? A. You are correct in your assertion.

(9490) J. H. M. asks: As I am running a new engine that has a bad pound in the cylinder that comes from a badly fitted piston, would you please advise me as to what is the correct allowance to be made for the expansion for piston rings? The above engine is a 20 x 20, speed 210 R. P. M., rated at 328 horse-power. The piston has a clearance of 3-32 inch, and the groove in the piston for the ring is ¾ inch deep; the rings are ⅝ inch deep; this allows the piston to ride all on the cylinder. Should not the ring be at least equal to the depth of the groove in piston? Please state what is good practice in this respect. The piston strikes the top of cylinder on the forward strike, making a very bad sound, otherwise the engine runs perfect. The piston is fitted with snap ring, or as better known spring ring, those being sprung on over the piston into the grooves; cylinder is of the overhanging type. A. The rings on the piston of your engine should not rest on the bottom of the groove, and should not carry the weight of the piston. The knocking may be caused by loose fit of boxes of the crosshead pin, crankpin, or main journal. There should be a take-up adjustment at all these points. We advise you to address the builder of the engine on your trouble.

(9491) H. S. B. writes: Would it be asking too much for you to inform me of a treatment or substance to use to make wood proof against water (or nearly so)? Our wood in the hames we make is in a few cases subjected to contact with sulphur water in the mines, and when saturated, softens the wood; would like a coating to prevent this, in a measure. A. For waterproofing hames we suggest soaking them for a few hours in boiled linseed oil, warmed nearly to the temperature of boiling water. On removing the hames from the bath, brush off the surplus oil, and dry in the sun or a warm oven. The addition of about two ounces of paraffine to a gallon of the oil by heating will make a finer finish to the hames by rubbing with a cloth after drying.

(9492) J. P. O. writes: In moving an object from place to place under a common arc light, the object appears to vibrate. What causes the apparent vibration? A. The apparent vibrations to which you refer are seen only when moving an object under an arc lamp fed by an alternating current, the light of which consists of a series of flashes which, due to the persistency of vision, appear to give

a steady beam of light. When an object is moved under this light, it is seen only at the points where it happens to be when lighted up by the flashes of the arc lamp, and due, again, to the persistency of vision, it seems to remain in each position for a brief interval of time.

NEW BOOKS, ETC.

PRACTICAL COAL MINING. By T. H. Cockin. New York: The Norman W. Henley Publishing Company, 1905. 8vo.; pp. 422. Price, $2.50.

The author of this work is a member of the Institute of Mining Engineers of England, and has been for a considerable period lecturer on coal mining at Sheffield University College. He has also had a varied practical mining experience. As the result of this, his book, while intended for the use of students preparing for mining examinations, or for qualifications for first or second-class colliery managers' certificates, is thoroughly practical in character, and gives much useful information in condensed form. Besides a map of the British coal fields, the book is illustrated with 200 specially-drawn diagrams. It will be found of great value to any person wishing to learn in a short time as much as possible about practical coal mining.

SMOKE PREVENTION AND FUEL ECONOMY. By William H. Booth, M.Amer.Soc. C.E., and John B. C. Kershaw, F.I.C. New York: Norman W. Henley Publishing Company, 1905. 8vo.; pp. 194; 75 illustrations. Price, $2.50.

This book is based on the German work of Ernst Schmatolla, to which, however, much has been added. The object of the authors is to show as briefly as possible the principles of fuel combustion, the methods which have been and are at present in use, as well as the proper scientific methods for obtaining all the energy in the coal and burning it without smoke. Considerable space is given to the examination of the waste gases, and several of the representative English and American mechanical stokers and similar appliances are described. The losses carried away in the waste gases are thoroughly analyzed and discussed in the Appendix, and abstracts are also here given of various patents on combustion apparatus. The book is exceedingly complete, and contains much that is valuable to all who have charge of large plants.

ELECTRIC SMELTING AND REFINING. By Dr. W. Borchers and Walter G. McMillan, F.I.C., F.C.S. London: Charles Griffin & Co., Ltd.; Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 562. Price, $7.

In this, the second English edition of Dr. Borcher's well-known manual (which has been translated from the third German edition of that work), the progress made in electro-technology has been fully chronicled. The great strides made in electro-metallurgical practice in the last few years have made the task of supplying all the latest information a very considerable one; this has been done quite thoroughly by Mr. McMillan, who, in translating, has added many valuable notes of his own. The work treats of all the metals in the extraction and working of which electric current has been found to be applicable, while only those processes which are capable of practical application have, as a rule, been described. A short survey of the purely metallurgical method of treating the metals has been added to each chapter, in order that the reader may compare such methods with electro-metallurgical processes, and see how the two may be used in conjunction. The matter has all been arranged with a view to the industrial aspect of the question, and there are numerous supplementary notes on actual applications of processes not otherwise referred to in the text. The book is very thoroughly illustrated, and forms a complete handbook on the extraction and treatment of metals by means of the electric current.

INFECTION AND IMMUNITY. With Special Reference to the Prevention of Infectious Diseases. By George M. Sternberg, M.D., LL.D. New York: G. P. Putnam's Sons, 1903. 8vo.; pp. 293. Illustrated. Price, $2.

The author, a retired surgeon-general of the United States army, here states for the benefit of non-medical readers the established facts relating to infectious diseases, and indicates the methods necessary for the prevention of such diseases. He has, so far as possible, let the various theories of immunity alone; his object being the diffusion of such knowledge as "cannot fail to promote the sanitary interests of the people."

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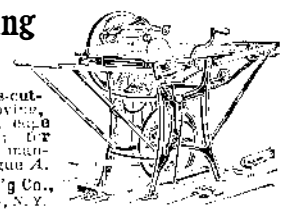

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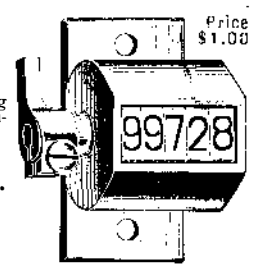

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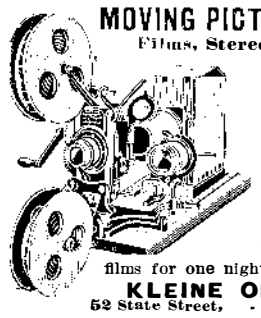
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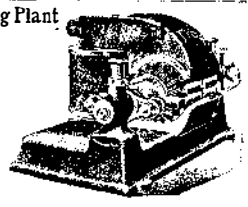

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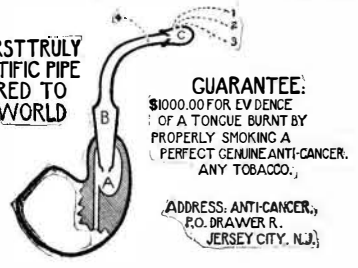
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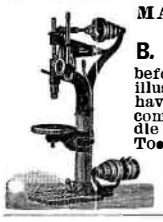

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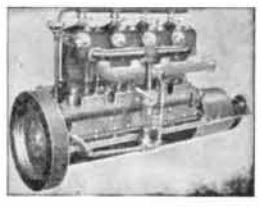

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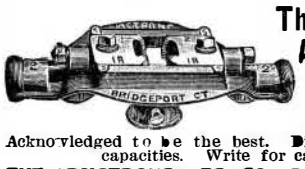

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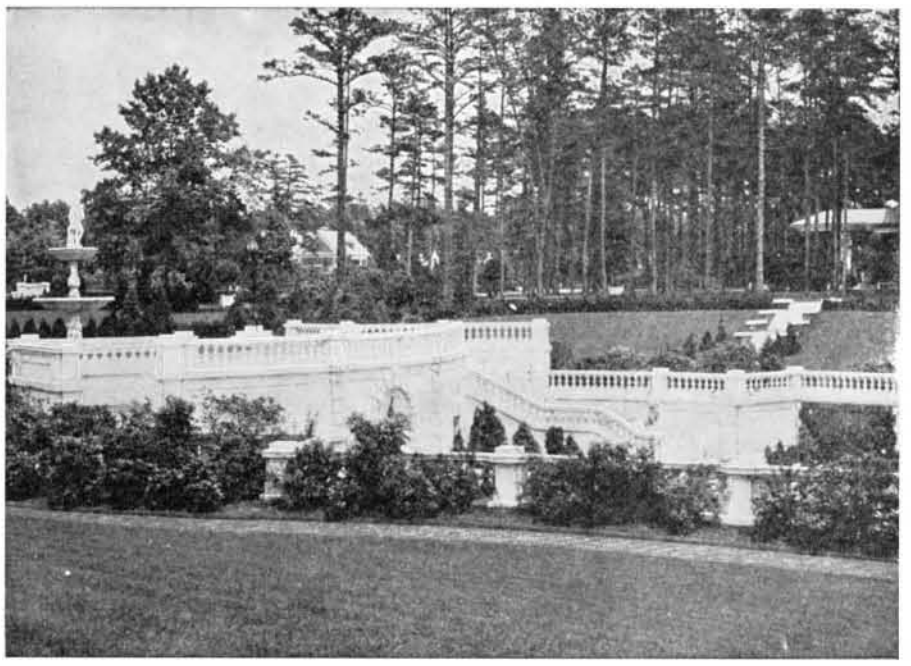

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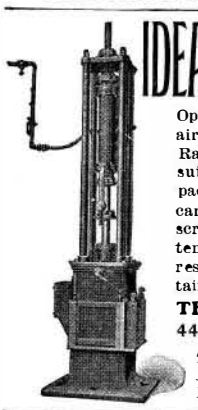

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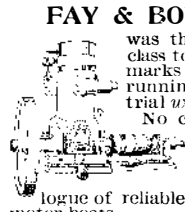

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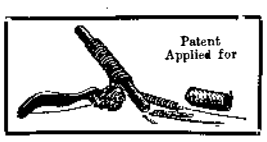

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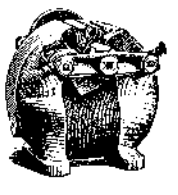

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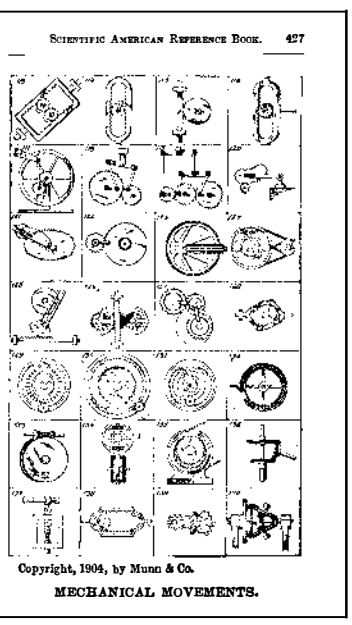

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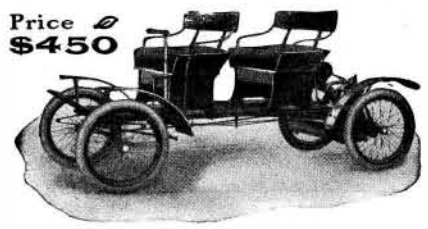

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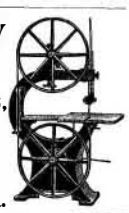

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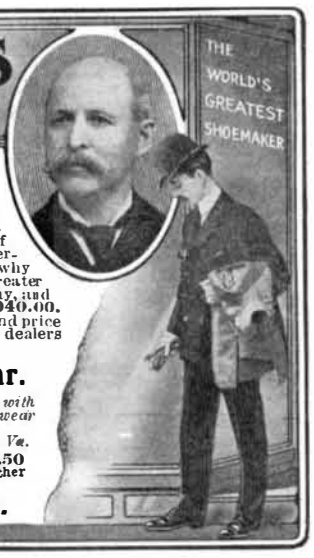

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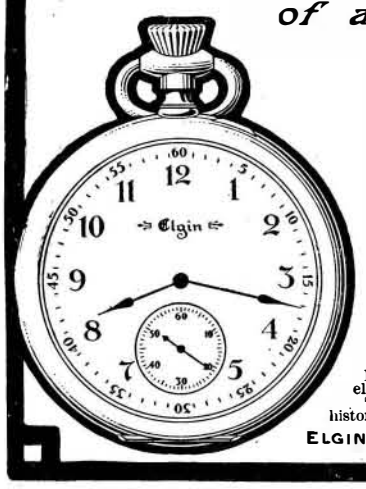

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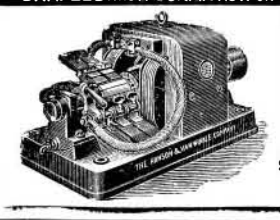

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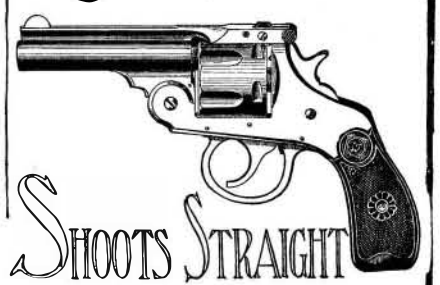

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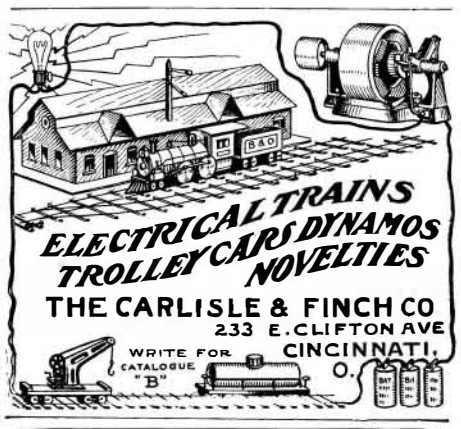

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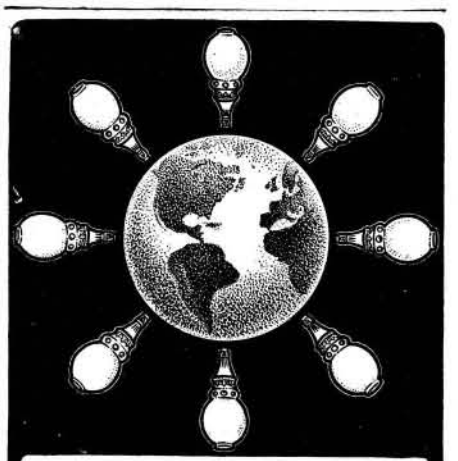

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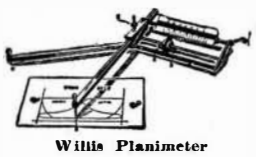

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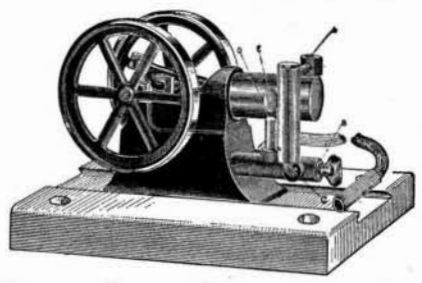

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